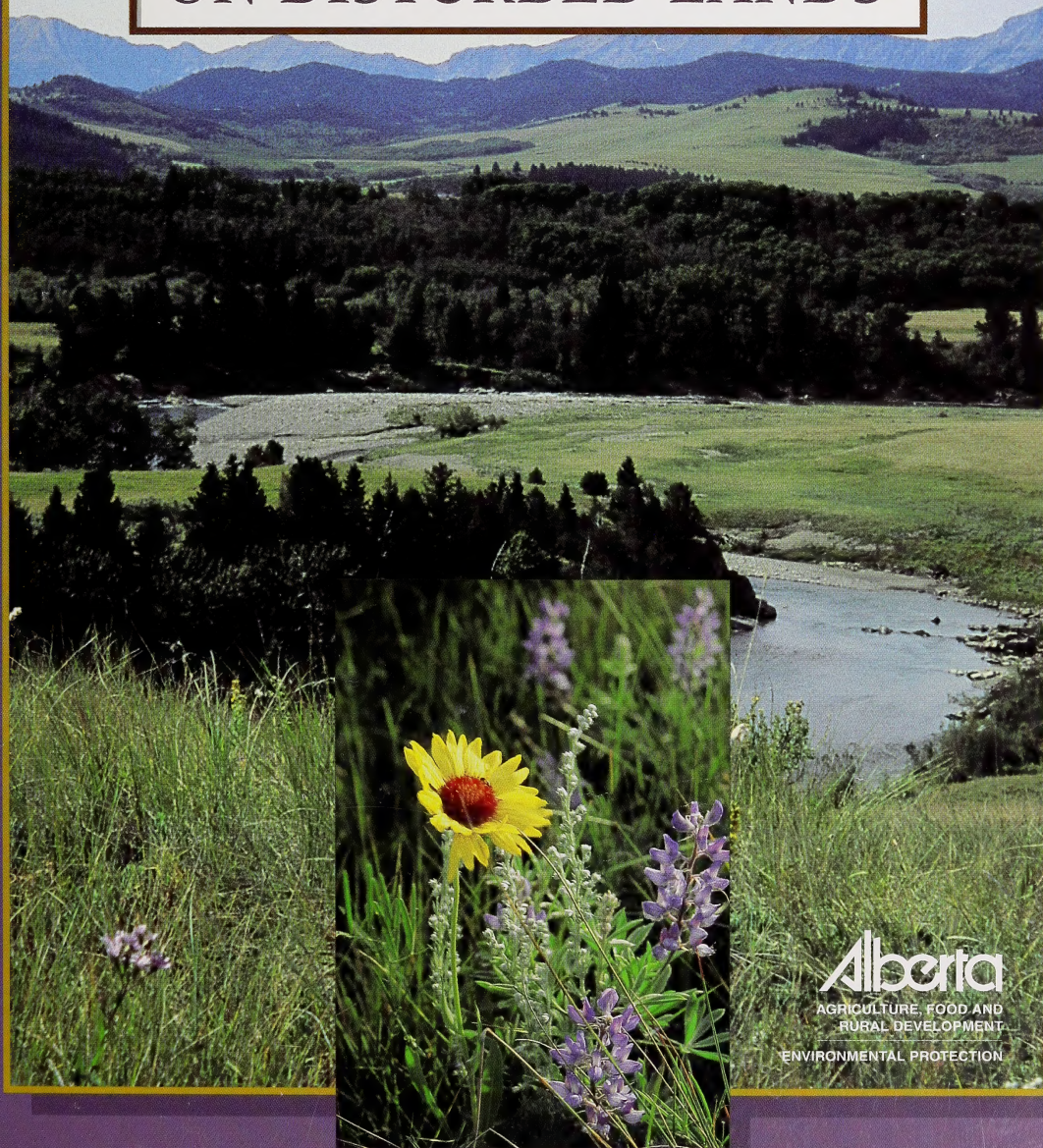


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A guide TO USING NATIVE PLANTS ON DISTURBED LANDS



Alberta

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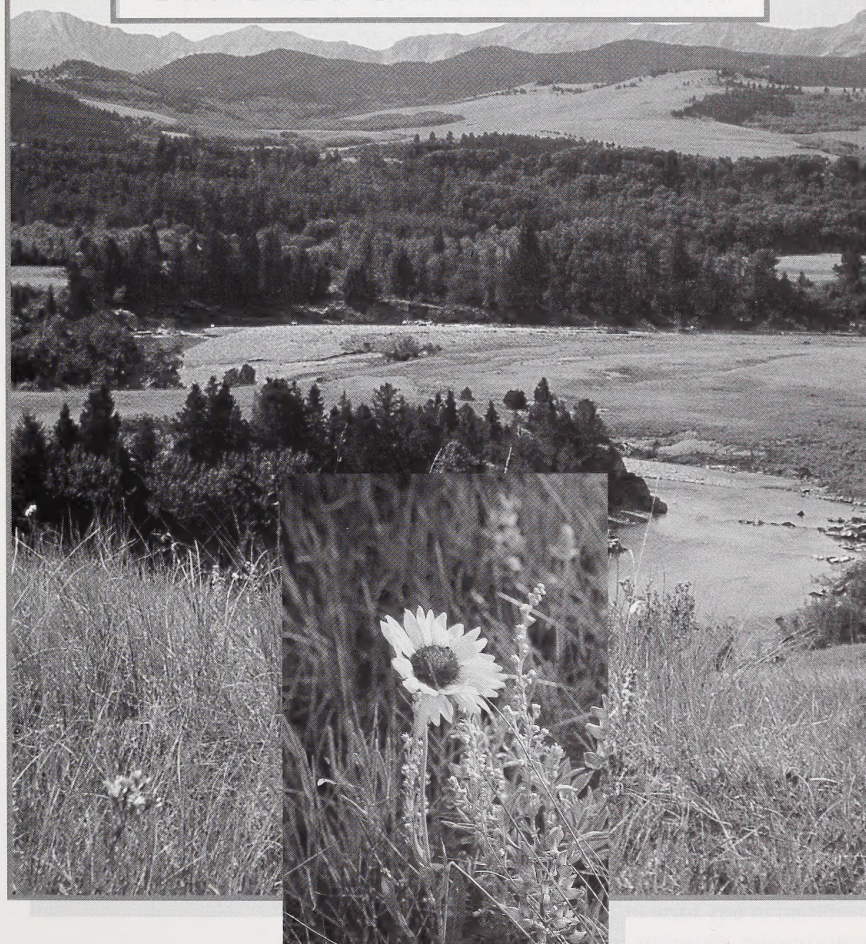
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A guide TO USING NATIVE PLANTS ON DISTURBED LANDS



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DISCLAIMER

This guide is intended to provide government and industry staff, as well as the general public, with up-to-date information regarding the use of native plants in reclamation and restoration projects.

The opinions, findings and recommendations expressed in this report are those of the authors and do not necessarily reflect the views of government, industry, consultants or academics. Mention of trade names, commercial products or seed growers/suppliers does not constitute endorsement, or recommendation for use.

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OUR TIME HAS COME

Once this was ours,
From montane heights to wind-shaped steppe,
And darkling wood to ice-carved parkland.


We waited,
Patiently, until you truly saw us,
And perceived that we belonged.

Our time has come.

See the land,
the forgotten spaces, known only by those few
who really stop to look.
Touched by effervescent images,
Echoic visions respond.
The lingering shades of landscapes past
Bespeak a future healing.

Stand at the threshold
It beckons,
Whispering to you—
Hear its great promise.

T. Gerling



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SECTION 1

introduction



PATRICK PORTER





INTRODUCTION

1.0 PURPOSE OF THE GUIDE

The purpose of this guide is to provide information about native plants found in Alberta, the communities in which they are found, as well as current knowledge about revegetation methods. There is an increasing interest in the use of native plants in Alberta. Government agencies and municipalities, industry representatives and reclamation contractors, seed producers and retailers, landscapers and gardeners, landowners and the general public have requested information about Alberta's native plants, as well as reclamation and restoration methods. The guide will provide a starting point for this diverse group to plan projects involving the use of native species.

Some government agencies in Alberta now require the use of native species that promote the recovery of original community structure and function in previously undisturbed native landscapes. This can be accomplished by seeding native species, but also by using alternative revegetation techniques. Examining the latter option may be advantageous to the reclamation industry, since the supply of native seed for many species is limited, or not currently available.

For the purposes of this guide, native plant species are those that are indigenous to a particular region i.e., they were in Alberta prior to the time of Euro-American settlement.

2.0 BACKGROUND

The emphasis in revegetating disturbed lands, until recently, has been on the use of tame or introduced species rather than the use of the original species, native to the pre-disturbed site. Introduced species, predominantly grasses, have been planted in the past because their aggressive growth characteristics give good protection against erosion. It is now known that some native plants are capable of the same erosion prevention as agronomic species.

When tame species were used, little thought was given to compatibility with surrounding native vegetation or land use in rangeland or forested areas. Areas revegetated with introduced species do not resemble the surrounding native landscape and have not allowed native species to encroach onto disturbed areas. Conversely, pre-1940s, unseeded, abandoned cultivation in prairie areas, has reverted to vegetation closely resembling the native communities surrounding them (Dormaer et al. 1994).

Special problems have been noted on sites seeded to introduced species. Many of the tame species used for reclamation have invaded native landscapes adjacent to the disturbed lands (Smreciu 1994). It has also been found that species like crested wheat grass and Russian wild rye do not maintain the chemical quality of native rangeland soils (Dormaer et al. 1994). Grazing potential is also lost when patches of incompatible species are placed in the middle of native range.

Growing season and palatability are often different, creating grazing barriers. In other cases, cattle are attracted to the disturbed area, creating tertiary or unused range elsewhere. Aesthetically, these sites do not match the surrounding vegetation.

The current use of native species in Alberta is variable. In southern and eastern Alberta, government agencies have required the use of native species for reclamation of native prairie on public land since the early 1990s. The use of native species on disturbances in forested areas is increasing. Some cities, municipalities and schools have started naturalization programs, using some native species in roadside, schoolyard, and park plantings. Other potential uses include: restoration of historic sites, waterway management, roadside beautification, increased use by florist and nursery trades, and cultural use by aboriginal peoples (Joyce 1994). These efforts can increase landscape diversity and interest, reduce spending on long-term maintenance, and prevent further intrusion by tame species into endangered native landscapes, such as the northern fescue prairie of central Alberta.

3.0

USING NATIVE SPECIES:

The Benefits and the Challenges

The value of native species for maintaining biodiversity is recognized. Biodiversity is defined as the biological variety of all life forms (West 1993), the genetic variation of their populations, and the variety of ecological communities in which they live and interact. Biodiversity is important for the following reasons:

- maintaining ecosystem functions, e.g. by providing services such as nutrient cycling, soil erosion control, nitrogen fixation, and balancing populations of pest species,
- maintaining ecosystem structure,
- providing a variety of ecological niches for other life forms,
- providing economic benefits and genetic diversity for the future, e.g. our domestic animals and cultivated crops were once wild; the potential economic uses of most native plants are largely unexplored,
- improving landscape aesthetics.

Ecosystems and the ecological associations among their members are complex and poorly understood. The importance of any one species may change from one season to the next, or may only be important during periods of environmental stress such as drought, flooding, or disease outbreaks. Furthermore, some species may have a relatively minor role within mature communities, but following a natural or human disturbance they take over important ecosystem functions until the mature community can re-establish. Our understanding of natural ecosystems is insufficient to accurately predict how sensitive they are to the loss of biodiversity (Baskin 1994), therefore, it is crucial that we make every effort to retain the biodiversity of our natural world.

The use of native plants for environmental restoration or reclamation projects on disturbed or degraded lands is just one step to ensuring biodiversity is retained. The current challenges of using native plants include:

- lack of information about species characteristics and ecology,
- poor availability of seed,
- high cost,
- difficulties associated with harvesting, cleaning, storing and seeding,
- unpredictable germination of seed, emergence and survivability,
- competition from non-native plants.

Some of these problems are currently being addressed by researchers. There are significant advances in equipment design, and information is being gathered about different species, seed mixes and revegetation methods.

4.0

DIFFERENT APPROACHES TO REVEGETATION

There are three basic approaches that can be taken to revegetate disturbed land: rehabilitation, reclamation, and restoration. They differ in similarity to the original predisturbed ecosystem (see Figure 1). Deciding which approach to use will depend on the type and size of disturbance, the goals of the revegetation project, the availability of materials, and the proposed end land use.

4.1 Rehabilitation

Rehabilitation involves the creation of an alternate ecosystem, with a different structure and function from the original system. Often rehabilitated land requires continual inputs such as fertilization or irrigation. Rehabilitation implies that the land will be returned to a form and productivity in conformity with a prior land use plan. This includes a stable ecological state that does not contribute substantially to environmental deterioration, and is consistent with surrounding aesthetic values (Powter 1994). This approach may be used on mined lands where tailings may not be able to support the original plant community.

4.2 Reclamation

Reclamation is the process of returning land to its former, or other productive uses (Powter 1994). Reclaimed land is structurally less complex than restored land, but a high level of ecosystem functioning is still retained. The Alberta Environmental Protection and Enhancement Act (1993) states that reclamation should achieve equivalent land capability:

“The ability of the land to support various land uses after reclamation is similar to the ability that existed prior to an activity being conducted on the land. The ability to support individual land uses will not necessarily be identical.”¹

Reclamation criteria for wellsites and associated activities have been developed jointly by government, industry and stakeholders in Alberta to measure reclamation success. These criteria include landscape, soils and vegetation components. The vegetation criteria include an assessment of plant health, species composition, as well as plant height, density and cover. More specifically, the plant species composition must usually be compatible with the original plant community, a neighbouring control site, or other reasonable land management objective. Reclamation criteria for other types of disturbances are in the process of being developed.

4.3 Restoration

Restoration is the process of establishing the original site characteristics (ecosystem) that existed prior to land disturbance. The goal of this process is to emulate the structure, function, diversity and dynamics of the specified ecosystem. This definition assumes that post-disturbance conditions are equal to pre-disturbance conditions. While restoration efforts can go a long way to retaining biodiversity and ecosystem functions, it needs to be recognized that the footprint of human activity might not be completely erased from the landscape, at least not in the short term.

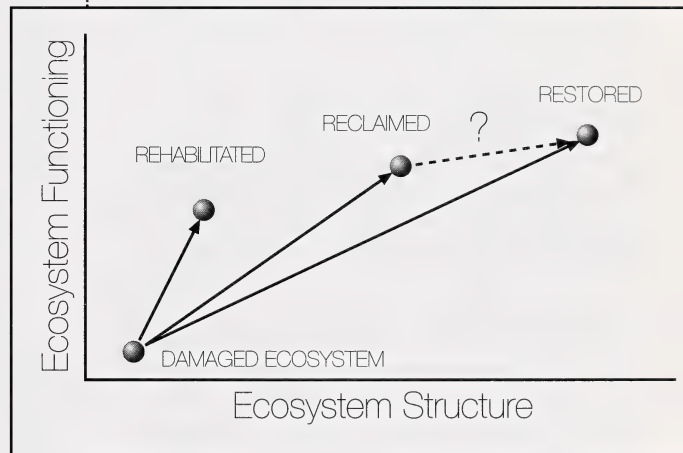


Figure 1: Models of goals to achieve restoration, reclamation or rehabilitation. (from Allen, E.B. 1995).

¹Conservation and Reclamation Regulation, Section 1(i) Alberta Environmental Protection and Enhancement Act, 1993.

5.0 SENSITIVE SITES

5.1 Avoidance

There are native landscapes in Alberta that are particularly sensitive due to: climate, rough topography, erosion-prone soils, presence of rare or threatened plants or animals, paleontological or archaeological significance or other unique features. Wherever possible, industrial or commercial activity on such lands should be avoided. Some ways of accomplishing this include: rerouting or finding alternate locations and directional drilling (for wellsites). On public land, Regional Integrated Decisions (R.I.D.s) can be reached by multi-stakeholder groups to decide what sensitive areas should be avoided.

5.2 Minimizing Impacts

There are also ways to minimize impacts of industrial activity. For areas with multiple well development, pad drilling may be an option. Special techniques such as laying pads of clay or wood chips over undisturbed vegetation before drilling or drilling right on prairie can limit the extent of disruption to sensitive native landscapes. Companies can pipeline along access roads and use common access to sites. Use of special equipment, e.g. the prairie protector, to move soil can also minimize disturbance to vegetation. If the soil is disturbed, it is important to conserve surface soils, as they contain valuable seeds and rhizomes. On very sensitive areas of public land, companies have developed Land Surface Management Plans that outline specific methods of reducing impacts.

Alternative soil handling methods and different seed mixes have been studied on a small (six inch) pipeline in southern Alberta (Adams et al. 1992). Evaluation after three years showed that the section where topsoil was not stripped and no seed mix was used, more closely resembled the off right-of-way native vegetation than any of the seeded areas. After five years, the bryophyte (mosses and lichens) layer recovered better on the area that was not stripped (Barry Adams, personal communication). Further study is required to determine other areas that can be reclaimed in this way to minimize disturbance to native prairie.

5.3 Alternative Revegetation Techniques

It may be necessary to consider alternative revegetation techniques on very sensitive landscapes where maintaining the integrity of the vegetation community is vital. Seeding with the few native grass cultivars that are available, for example, may not give the desired end product. The introduction of persistent introduced weedy species is also a risk when using native seed mixes. It is important to remember that the use of native species in Alberta is in its infancy, and that a lot of experimentation needs to be done. For example, a collaborative government/industry/academic effort to evaluate a number of revegetation techniques on native prairie in Alberta will begin in 1996. It is hoped that this initiative will expand to forested and mined areas.

The following alternatives to seeding with native cultivars can be considered on suitable areas where materials are available:

- Diverse native seed can be harvested on-site, or from similar plant communities in the immediate area, for replanting on the disturbed area. This may have to be done at intervals, e.g. June, end of July and September to take into account different seed maturation dates. Seed strippers are available in Canada and the United States.
- On smaller sites, e.g. pipelines and wellsites, where native vegetation surrounds the site, it may be possible to allow recovery by natural plant succession. An annual crop such as barley can be planted at half the normal rate or straw crimping can be used to provide erosion control if necessary. The annual should be mowed to minimize competition for light and water. On public land in Alberta this must be discussed in advance with the Conservation and Reclamation Inspector (CRI). Both parties must clearly understand what time frame real success will be measured in.
- Sod stripping and replacement can be used successfully on small disturbances. When grasses are thick, it is advisable to mow the source area first. Sod can be cut to a depth of 5 cm with conventional sod-cutting equipment. This favors shallow-rooted species. The resulting stand reverts to an earlier stage of succession for a number of years (Revel 1993). A step-blade can be used to cut sod to a 10 cm to 15 cm depth.

- Stripping and replacement of the topsoil seed bank has also had favorable results. The top few centimetres of litter and soil, containing rhizomes and seeds, is stripped and stored prior to stripping the remainder of surface soil and subsoil. During reclamation, the topsoil seed bank is scattered back over the surface with a manure spreader and harrowed.
- When native hay is available, it can be crimped or disced into the soil during reclamation. It is necessary to use a "bale-buster" to break the hay up into smaller pieces. Light disking, followed by rolling, improves the soil to seed contact. Seed in the hay is limited to those species that are ripe at the time of haying, or which ripen during storage.
- Sprigging can be successfully used to transplant highly rhizomatous plants, usually grasses, e.g. sweet grass. Special machinery is used to harvest small pieces of grass crowns, roots and rhizomes that are replanted and sprout new plants from rhizome nodes. It is best to use native plants grown in a cultivated setting as a source for sprigs. Harvesting can be quite destructive to non-rhizomatous plants in natural communities.

6.0 USING THE GUIDE

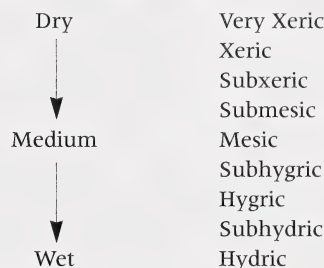
Although alternative reclamation techniques can be used in some situations, there are many projects that require the use of native seed, due to size of the area to be revegetated, lack of suitable materials or erosion concerns. The guide provides information about plant communities and species for the user to make their own decisions about what is best for a specific project. There is insufficient knowledge and native plant materials at the moment to provide specific seed mixes for different site types. The user is strongly encouraged to talk to people in their area who have used or grown specific species. Contacting a local seed supplier is a good place to start (see Appendix B).

6.1 A Step-by-Step Approach

The following steps will help the user get the maximum benefit from the guide:

- Determine the revegetation objectives for the site based on end land use.

- Assess what impact the activity has had/will have on the reclamation product, e.g. the removal of sand/gravel/peat/coal etc., may change the ecosystem quite drastically.
- Determine the natural region and subregion that the site to be revegetated is in, by referencing the map of the Natural Regions of Alberta (page 27).
- Assess the moisture regime of the site:



- Reference Section Two of the manual to determine what species might be expected if the site was ungrazed and late successional.
- Conduct an on-or off-site assessment to determine the relative abundance of native plants in the area.
- Decide whether natural recovery or the use of wild harvested seed from the same natural region is feasible.
- If natural recovery or alternative revegetation techniques are not an option, design a seed mix using the guidelines presented in the manual. Reference Section Two for information on the presence/abundance of plant species in the relevant vegetation community. Section Three can be consulted for additional information on the morphological and ecological characteristics of particular plant species, as well as its suitability for the intended end use.
- Determine what species are available. Yearly updates of species availability and suppliers are available from the Alberta Native Plant Council, Box 52099, Garneau Postal Outlet, Edmonton, AB T6G 2T5. For more current information contact the seed suppliers listed in Appendix B directly.
- Order seed, taking into account germination rates, number of seeds/g, scarification requirements, absence of weed seeds, etc.
- Use seeding rates and methods that are appropriate for the intended use, climate and soil type, and the species being seeded.

- l. Record the seed mix and procedures used; monitor and record success.
- m. Share your successes and failures.

6.2 Vegetation Communities

(Using Section Two)

The second section of this guide describes some of the vegetation communities found in the natural regions and subregions of Alberta (Alberta Environmental Protection 1994), for which data are currently available. Sites are classified according to moisture regime classes developed by Walmsley et al. (1980). These classes indicate the relative amount of moisture available for plant growth over the growing season. Climate, soils and landscape information are also provided for each community, along with potential reclamation problems.

The vegetation data were collected from undisturbed range benchmark sites monitored by staff from Public Lands Branch (Alberta Agriculture, Food and Rural Development) in the settled (White Area), and staff from Land and Forest Services (Alberta Environmental Protection) in the forested (Green Area). Canopy cover estimates were made using the Daubenmire (1959) method. Further information on methods can be found in Robertson and Adams (1990).

The species listed are only a guide, and the percent cover values are averages. A pre-disturbance or off-site assessment should be conducted to determine the relative abundance of plants in the disturbed area. For example, the vegetation around many reclamation sites is grazed, and may show considerably different plant cover values than those presented in Section Two. A measurement of plant density rather than cover is probably more useful for determining an appropriate seed mix for reclamation or restoration. This is information that is currently unavailable; however it is likely that plant density data for different community types can be collected over the next few years.

Two types of species are identified in plant community descriptions:

- a) Plants that establish quickly on sites following disturbance are identified by an E (early successional),
- b) Plants that establish later following disturbance are identified by an L (late successional). It should

be noted that some species are early to midsuccessional in one community but may be considered late successional in another.

There are only a few species native to Alberta for which seed is available in abundance, mostly grasses. These are listed under each community description. Seed companies and private growers were surveyed to determine commercial availability i.e., those species that are usually available in volumes greater than 100 kg. As more species become available, they should be incorporated in mixes. It should be noted that plugs of shrubs and trees are readily available from many nurseries.

Some species, e.g. little club-moss of the mixed grass prairie, are totally unavailable at the moment, either because it is not known how to propagate them or because their role in the plant community is poorly understood. Though unpalatable to cattle, the low growing club-moss forms a mat over the dry soils of southern Alberta, providing important erosion control, particularly in heavily grazed pastures.

6.3 Species Characteristics

(Using Section Three)

The Species Characteristics section of this guide provides anatomical, physiological and ecological information about the plant species listed in Section Two. This information is useful for formulating seed mixes or propagating plants. It can help to determine whether a plant should be included in a mix for revegetation. For example, a plant with poor forage value for livestock would not usually be included in a mix for pasture, however, the same plant might be beneficial if placed on an area intended for wildlife use.

Information about growth form can assist project managers in planning for architectural variability. The tables in Section Three also indicate relative numbers of seed per gram, as well as species ecology. This information may help to determine how much of the species to put in a mix. For example, if a plant is very aggressive, e.g. designated as strongly rhizomatous, early successional or an increaser, it may be wise to put less of it in a mix, if the objective of revegetation is restoration. If erosion control is the primary objective, then use of a more aggressive native species might be appropriate. Designation of species as cool or warm season helps to determine when it should be seeded.

Cool season species germinate early in the spring in Alberta, however, warm season species require temperatures above 10° Celcius to start growing. Soil texture, moisture and tolerance information can be used to decide where it is appropriate to use specific plants.

7.0 SITE PREPARATION, SEEDING, AND FOLLOW-UP CARE

People with an interest in small restoration projects probably will not have difficulty locating seed. However, seed for large reclamation projects may be more difficult to find. There are a few cultivated varieties of native seed that have been developed; the supply of these, e.g. wheat grasses is relatively good. A lot of seed is being used that comes from a long distance away. This may affect both performance and the local gene pool. Substitutions of non-native or inappropriate native species may have also occurred because of unavailability, or due to a lack of knowledge about what plants grow in Alberta's native plant communities.

7.1 Types of Native Seed

There are three types of native seed currently available in Alberta:

- Native cultivars usually available in abundance from seed retailers,
- Common seed propagated from Alberta native species in a cultivated setting,
- Common seed harvested in volume from wild plant communities.

Ecovars (ecological varieties), a fourth type of native seed, are in development at various research stations across the prairies (see Appendix A for species and locations).

A cultivar or cultivated variety is developed with rigid selection for agronomic characteristics, such as seed production or disease resistance. Many of the cultivars used in Alberta are from Saskatchewan, Manitoba or the northern United States. Seed originating in the dry grasslands of Montana can be used in southern Alberta; use the 500 km guideline for northern movement. See section 7.4.4 for more information on distances that seed can be moved.

An ecovar or ecological variety is usually defined by its ecological niche, or set of climatic or other conditions under which it will grow and develop normally (Joyce 1994). It is also developed with equal emphasis on genetic diversity and agronomic characteristics. It is hoped that the use of ecovars in the future helps to maintain the genetic integrity of local populations, and avoids the introduction of artificially selected genetic traits into natural populations. Until ecovars are available, it is necessary to use suitable native cultivars in many reclamation projects because of availability problems.

Wild seed is harvested directly from native populations of plants. There are a number of native seed growers in Alberta who have cultivated seed collected in the wild. There are others who specialize in collecting wild seed with special harvesters/seed strippers every year. Wild seed shows more genetic diversity than either cultivars or ecovars. Appropriate timing of harvesting and harvest method is critical to ensure maximum genetic diversity since only a small percent of individual plants may produce seed in a given year. Harvesting several times over a season, or over a period of years, increases genetic variability and adaptability (Joyce 1994).

7.2 Deciding What to Plant

This decision must be based on consideration of a number of factors. First the objectives for the planting must be clear. How closely must the finished product resemble the original native community? Is erosion a concern? How will present or past use and soil properties affect plants? How will the end land use affect the planted species? Once these questions and other pertinent ones are answered, apply those principles that fit the objectives of the project. Some of these principles include:

- Simulate the off-site landscape diversity, e.g. topography, soils on the area to be reclaimed or restored.
- Re-create smaller scale patchiness of vegetation species, if possible, e.g. clumps of shrubs where appropriate.
- For restoration projects, use as diverse a seed mix as possible, unless competition will inhibit establishment of desired plants.

- Use native seed (as available) in amounts that will result in plant densities similar to the community that is being mimicked (note that research in this area is ongoing; talk to those who are most familiar with the species you are interested in or do some small-scale trials first).
- Introduce architectural variability, e.g. low and tall growing species.
- Use grasses and forbs that differ in growth characteristics, phenology and physiology, e.g. bunch vs. rhizomatous; different flowering times.
- Include keystone or critical link species if they are known. These are plants that contribute more than others to critical ecosystem functions (Westman 1990). The absence of keystone species may severely inhibit the growth of other plants or affect animal populations that depend on them (West 1993).
- Use short-lived species, e.g. slender wheat grass, in higher proportions when erosion control is required but movement of offsite native species onto the area is desired.
- Include nitrogen fixers like legumes if available, as they will actively improve the nitrogen content of the soil. This may be particularly beneficial on sandy soils.
- Be aware that rhizomatous species, e.g. western wheat grass, can spread easily with underground roots, therefore, it is probably advisable to limit their proportion in a seed mix to a small percent so that they will not dominate the site.
- Consider the palatability of various species to livestock and wildlife. If a species is poisonous to livestock, and the end land use will be domestic grazing, then the plant should not be included in the seed mix.
- Avoid using large proportions of plants that have known allelopathic effects (growth inhibiting chemicals).
- Limit the proportions of new species in mixes, until the species proves itself successful, e.g. germinates and establishes readily and no problems are noted with over-competitiveness, etc.
- Consider unique characteristics of sites such as: high salt concentrations, low organic matter, soil compaction, very low or high pH or drainage problems, and use plants that are adapted to the conditions.
- Consider unique characteristics of plants, e.g. plains

rough fescue is very slow to establish (grows one to two inches in the first year) and does not tolerate competition (Robin Hunka, personal communication). In this case, it may be better to seed the species by itself, and add other plants once the first species is well established.

- Discuss your objectives and choices with landowners, lessees, government representatives and other affected parties.
- Educate the public about the project. Many people have the impression that native plants are weeds. It is important that they understand what is being done so that they don't feel threatened by it. They may also be an important source of assistance.

7.3 Site Preparation

A well prepared site is essential for ensuring the success of native revegetation projects. Poor site preparation is the major reason for failure of restoration efforts. Lead time is very important to evaluate existing conditions and prepare the area properly. Valuable time and money can be saved by doing this.

7.3.1 SOIL

If topsoil is stripped prior to industrial use, it should be carefully conserved. Topsoil contains a wealth of microbes that are important in nutrient cycling, and seeds and rhizomes that are still viable, even years later. If topsoil is going to be stored for a long period of time, it is best to spread it thinly, but not so thin that it can not be taken up again. The stored soil should be vegetated with native species to prevent erosion and to maintain biological viability.

When reclaiming abandoned sites, it may be necessary to alleviate subsoil compaction by ripping prior to topsoil replacement. If straw is used to remedy compaction, ensure that it is spread evenly and that it is well incorporated into the subsoil. Available soil is replaced evenly over the disturbed site.

Topsoil should be packed in preparation for drill seeding. At least two passes at right angles with a roller packer are recommended. This ensures good soil to seed contact, eliminates air that could dry out seedlings and keeps moisture in the soil. Packing should be firm enough that a footprint can barely be seen (Morgan et al. 1995). On areas that are broadcast seeded, packing should be done after seeding.

7.3.2 WEED CONTROL

An effective weed control program is essential for at least one growing season prior to seeding to ensure the success of native species establishment. Where weeds have been growing for a long time, there will be a lot of their seed in the soil. Several years of control may be required. Light cultivation of the area several times prior to seeding may be possible in areas where climate and soils permit, providing that erosion and soil pulverisation are not a concern. Deep cultivation is not advised on previously cultivated areas, as it will bring weed seeds to the surface.

Herbicides must be used carefully as some will leave residues in the soil that will harm the growth of native forbs. For sites surrounded by native vegetation, introduced weeds will be less of a problem, unless brought in by equipment. All equipment and materials, e.g. pipes, must be cleaned of weeds prior to entry. Only control those weeds that are designated as restricted or noxious, or are known to compete with desired native species in a detrimental fashion. These weeds should be spot-sprayed with appropriate herbicides. Research has shown that non-aggressive weedy colonizers may facilitate establishment of desirable native species (Allen 1990).

7.3.3 MULCHING AND CRIMPING

Mulching or crimping using native hay, or weed-free straw, is beneficial for many types of reclamation and restoration. These techniques aid plant establishment by helping to prevent erosion, insulating the seed, trapping snow and helping water to infiltrate into the soil (Kerr et al. 1993). In mulching, bales are broken up into small pieces using a "bale-buster". If native hay is being used as a seed source, the broken bales are lightly disced into the soil and then packed firmly. Sometimes mulch is spread over an already seeded area, and a tackifier or other method used to hold it in place.

Crimping involves spreading straw evenly over the site without breaking it into small pieces. A straw crimper with a rolling drum is used to press one end of the straw into the soil, so that the other end is pushed upright. Crimping is commonly used on industrial sites in southern Alberta for erosion control. The "volunteer" wheat or flax that germinates from seed in the straw can be mowed, if it is competing with native plant seedlings for light or water. Testing bales

of native hay and straw for weeds must be done to maintain quality control. For large projects, it may be worthwhile to ensure quality by contracting someone to grow the crop that will be used for crimping.

7.3.4 FERTILIZATION

Fertilization of native plantings is not presently recommended for most restoration or reclamation work. Nitrogen, in particular, seems to promote weed growth that competes with native plants. Adding fertilizer may affect natural succession processes by favouring some species over others. Addition of phosphorous may be beneficial in helping seedlings establish, especially on sandy soils. More research is required to understand the relationships between fertility and native plant establishment, competitiveness and succession.

There is an experimental technique known as soil impoverishment that reduces the amount of nitrogen in the soil by incorporating large amounts of organic material (Morgan 1994). Soil microbes that break down the organic material tie up available nitrogen in the soil for one to two years. This technique has been used by the forest industry to promote the growth of trees over herbaceous plants. Impoverishment may give native perennial plants an edge over weedy annual species during the first couple of years following treatment.

Impoverishment techniques could also potentially speed up the successional process on disturbed areas. Nitrogen (N) availability was found to be a primary mechanism controlling the rate of succession in one semi-arid community in Colorado (McLendon and Redente 1994). As N availability increased, the rate of succession decreased, with annuals dominating the area. Conversely, as N availability was experimentally decreased, the rate of succession increased and perennials become abundant more quickly.

Annuals, including many weeds, accumulate available N quickly because of their high growth rates. Perennials, as most native plants are, have lower N requirements, because of lower tissue-N concentrations (especially grasses) and perennial storage between years.

7.4 Purchasing Seed

There are a number of guidelines to follow when ordering seed to ensure the success of a revegetation

project and to keep costs down. Since demand for native seed usually exceeds supply, it is necessary to plan as far ahead as possible and talk to the seed supplier. Appendix B lists seed suppliers and Section Three of the guide indicates which seed supplier is likely to have seed for particular species. It is hoped that more local sources of seed emerge over the next few years, as demand increases.

7.4.1 PURE LIVE SEED

Pure Live Seed (PLS) is the amount of live or healthy seed found in a seed lot, excluding weed seeds and chaff. Ask the seed supplier whether their price is based on a Pure Live Seed or bulk seed basis:

PLS = % germination x % purity (excluding inert material, weed seeds, non-viable seed)

In the United States, it is possible to order seed on a PLS basis, taking into consideration germination and purity. In Canada, seed is not often purchased on a PLS basis. Seed trading is on a bulk seed basis. Prices on mixes and individual species are published by most companies on the bulk pound or kilogram basis (Kerby Lowen, personal communication).

There are two ways to determine the germination potential of seed. One is the standard blotter test where some species germinate very poorly, e.g. western wheat grass. This can give an inaccurate idea of germination potential because the same seed may germinate very well in soil. A better option is the T.Z. (tetrazolium chloride) test, a chemical that will stain living seed. For example, a T.Z. test indicating 90% viable seeds means that 90% of the seed is living, but it does not indicate whether the seed will germinate or stay dormant. Some seed can remain dormant in the soil for several years, germinating only when conditions are optimum.

7.4.2 CERTIFICATE OF SEED ANALYSIS

It is extremely important to use seed that is free of restricted, noxious, or nuisance weeds. In Alberta there is also zero tolerance by government agencies for invasive agronomic species like smooth brome or crested wheat grass in native mixes. The buyer should always ask to see the certificate of seed analysis (See Figure 2). In Canada, seed analysis is reported by the number of weed seeds in a 25 gram sample. Since this is a very small sample, it is advisable to ask for dou-

ble sampling when dealing with a large seed lot or when there is more concern that a seed lot may contain noxious or nuisance weeds, e.g. downy brome.

7.4.3 SEED SUBSTITUTION

Substitution of seed often occurs when the specified native seed is not available. It is important to clearly indicate to the seeding subcontractor or to the seed company what substitutions are acceptable; listing first and alternate choices is a good idea. If good communication between the seed company and buyer is developed, then the seed company can make suggestions for substitutions at the time the specifications are written.

7.4.4 DISTANCE THAT SEED IS MOVED

It is important to ensure that the native seed used on a site is suitable for the soil, topography, elevation and climate of the area. Using seed originating from areas with very different environments can result in less competitive plants, loss of genetic diversity and hybridization with local types. This may potentially eliminate characteristics specific to the local population before they can be studied and understood (Rock 1981). The distance that species should be transported from the source varies with the plant. Romo and Lawrence (1990) have proposed that plants of a certain ecotype can be moved 400 to 500 km north and 150 to 250 km south and still perform in the same way that they did in their original location. East-west movement is dependent on precipitation and elevation. A 300 metre change in elevation equals a move of 280 km northward (Joyce 1994). More research is required in this area, to determine exact limitations for individual species.

7.4.5 STORAGE

Over-heating (within hours) and growth of fungi can occur following harvesting due to inadequate drying of seed following harvesting. Seed should be kept dry and at cool temperatures (4° C) or frozen when it is stored. Humidity should be less than 10%. Temperatures over 28° C will reduce viability of seed very quickly (Morgan et al. 1995).

The storage life of native seed varies with the species and with the source of seed. Some species remain viable for years. In one study, june grass showed a

collect common species or those with a large population.

- Find out when plants are in bloom (varies from mid April to late October). Flag or label plants with a marker while in bloom, or be able to identify the plants in seed (note that deer, elk and antelope are known to eat surveyor's tape).
- Collect undamaged ripe seed or cuttings, not entire plants (unless essential for identification).
- Leave 50% of the seed in place to allow natural propagation, and to provide food for insects, birds and small mammals.
- Collect minimal amounts (from no more than 10% of the plants) in areas that may be subjected to further collecting by the general public or where grazing reduces natural regeneration.
- Leave an area to rest for at least a year between collections.
- Avoid the use of heavy machinery when soils are soft or wet to prevent rutting.

7.6 Seeding

For successful seeding of native species, it is important to use an appropriate seeding rate using specialized equipment if necessary. Timing of planting and proper seed placement are important to take advantage of the best moisture conditions and to meet individual species requirements. There are several recent Canadian references that are worth consulting for seeding native grassland species: Morgan and Collicutt 1995; Ducks Unlimited 1995; Kerr et al. 1993; Abouguendia, Z., 1995.

7.6.1 SEEDING RATES

Seeding rates vary depending on what the planting is being used for, the species seeded, seed size and purity, cultivars vs. common seed, projected seedling survival, seeding methods and row spacing, as well as the climate and soils of the area. Since some of this information is not available for many species, it is best to consult with someone who has seeded the species in the area for the same purpose to get an idea of what works best. If the goal is to mimic a particular native community, then the density of plants there gives a good indication of what to aim for.

SEEDING FORMULA (FOR ONE SPECIES):

$$\frac{\text{Desired Live Plants/m}^2 \times 10^*}{\text{Seeds/gram} \times \% \text{ P.L.S.}} = \text{kg/ha of seed}$$

*Conversion from g/m² to kg/ha

To convert to lb/acre, multiply by 1.1208

e.g. In an offsite examination, *Stipa comata* plants were found at a density of 20 plants/sq. m. To calculate the seeding rate for this species (assuming a PLS of 50%)

$$\frac{20 \text{ plants/sq.m} \times 10}{250/\text{g} \times 0.50} = 1.6 \text{ kg/ha (or 1.8 lb/acre)}$$

Note: This formula does not take into consideration dormancy factors, hard seed coats, germination potential (in succeeding years) and expected % of seedling survival (sometimes as low as 25%). If these are known or can be estimated, adjust the seeding rate accordingly. Note that the rhizomatous habit of many grasses and some forbs, shrubs and trees can compensate somewhat for poor initial establishment.

It is also useful to know relative seed weight when deciding what seeding rate to use. The same weight of large heavy seeds does not cover as big an area as small, light seeds. Also, the mortality of small light seed is generally very high. Small seeds are seeded at a greater number of seeds/acre than large seeds, however, the overall weight of the small seeds is less. Information about seeds/gram for some species is provided in the Species Characteristics section of the guide.

Rates of seeding for reclamation are usually lower than rates for restoration or pasture rejuvenation. For example, rates of 8-11 kg PLS/ha are often used for drill seeding native grasses on reclamation projects in southern Alberta. Higher rates are used if erosion control is the objective; if seed is broadcast (2 to 3 times the recommended rate for drilling) or if weed populations in the area are high.

If the intent is to let native species from off-site encroach over time, then it is best to seed lightly. Heavily seeded stands of native grass may look good in the short term but may stagnate and die off over time, due to competition among plants and accumulation of litter. There has to be a balance between the short term goals of erosion and weed control in reclamation, and a long term goal of sustainable native vegetation that is similar to the surrounding area.

For pasture rejuvenation, row spacing recommendations are 12 to 18 inches in the Brown soil zone and 12 inches in the Dark Brown and Black soil zones (Abouguendia 1995). Wider spacings are suggested for hay and seed production (up to 1 metre). A commonly used measure for pasture seeding is about 100 pure live seeds per linear metre of row.

7.6.2 TIMING

Spring, early summer or late fall seeding is recommended to take advantage of the best growing conditions in Alberta. Less seed is wasted and better establishment occurs if species requirements are understood. Cool season species, e.g. rough fescue, should be seeded in early spring (April to mid May) or in late fall (after mid October). When soil moisture is good, cool season species can germinate when soil temperature is 5 to 8°C. Warm season species, e.g. blue grama grass, should be seeded later (mid May to mid June), since higher soil temperatures (10 to 12°C) are required for germination. Some species, e.g. green needle grass; needle and thread grass germinate and grow better if seeded in late fall.

7.6.3 SEEDING METHODS

The two most commonly used methods of seeding are drill seeding and broadcasting, with the former being most efficient in terms of the amount of seed used. If a native mix is drill seeded, specialized equipment, e.g. Truax, Tye, Nesbit, John Deere rangeland drill or equivalent, is required due to the variability in seed size and shape. Clean seed is a must, as even small amounts of straw plug drills. Special agitators are required when seeding light fluffy seed or seed with awns. Inert carriers, e.g. cracked wheat, vermiculite or sand can be used to improve the flow of seed through seeders.

Broadcasting involves spreading seed on the surface of the ground and can be done by hand or with hand-held or tractor pulled machines. Seed should be lightly raked in or incorporated by dragging a heavy chain over the seeded area. Roller packing afterward will enhance soil to seed contact (Morgan et al. 1995). To get more even coverage, divide the seed in half and cover the area twice; the second time at right angles to the first. It is also possible to broadcast seed from the air; pipelines are sometimes seeded this way.

Seed predation is another consideration when broadcast seeding. Birds and rodents can consume large amounts of seed. The forest industry, for example, has broadcast seeded large areas in late winter to alleviate seed predation. The dark seed accumulates heat and melts into the snow surface, becoming unavailable to rodents. By the time the snow melts, the seed is ready to germinate because light and heat stratification have taken place (Steve Ferdinand, personal communication).

7.6.4 SEED PLACEMENT

Seed placement is dependent on species requirements and the soil texture and moisture. When drill seeding, seed should be placed at a depth no more than 1½ times the diameter of the seed. Seeding too deep is a common cause of seeding failure. It is usually not necessary to seed deeper than 1.25 cm to give the seedling enough moisture. On sandy soils, seed can be sown deeper (up to 2.5 cm). A drill with depth bands should be used to ensure proper seed placement. It should be noted that warm season grasses, e.g. blue grama grass, cannot be sown deeper than one centimetre. Some native seed, e.g. june grass may require light to germinate. These species should be broadcast.

7.7 Erosion-Prone Areas

The erodability of a site increases the risk of seeding failure. There are a number of measures that can be taken to reduce this risk:

- Seed at a higher rate.
- Use species that establish quickly.
- Use species that are rhizomatous.
- Drill seed in two directions (cross-seeding).
- Use straw crimping or tackifiers on sandy or very dry soils, e.g. southeastern Alberta.
- Use straw bales, or logs to help prevent movement of soil and provide a better micro-environment for plants to grow in.
- Irrigate the site after seeding.
- Plant a companion crop at half the normal rate (annual crops or short-lived native species, Canada wild rye or slender wheat grass) with the seed mix. Avoid using wheat or fall rye as they give off chemicals that inhibit the growth of some native plants. Using a companion crop may not be possible in dry

areas where it may compete with native seedlings for moisture. Mowing and baling the companion crop before it goes to seed may be helpful in removing competition.

- Grow an annual cereal crop in the year prior to seeding native species. This crop is mowed prior to seed set to prevent “volunteer growth” the following year. This may have a number of desirable effects, e.g. stabilizes the soil, allows for weed control, allows for early diagnosis of soil problems and may reduce the amount of available nitrogen for weeds, thereby enhancing establishment of perennial native species.

7.8 Follow-up Care

Weed control is the main follow-up care required. Annual weeds and early successional native species usually dominate sites in the first couple of years. Many native seedlings fail because of intense competition from annual weeds. Mowing and baling is suggested prior to seed set to control them. This should be done high enough to miss most native seedlings.

Perennial introduced species, e.g. Canada thistle, smooth brome, quack grass or persistent annuals like downy brome (cheatgrass) require immediate attention. Environment Canada (1993) and Alberta Agriculture, Food & Rural Development (1983) have publications that discuss the biology and control methods for these species.

Repeated mowing does control Canada thistle; repeated burning has also been effective. Undesirable invaders such as smooth brome often grow faster following burning or mowing than desirable native plants. This makes it possible to apply a wick application of herbicides, e.g. glyphosate to eliminate the non-native plants.

Grazing, burning or periodic harvesting is required to maintain the viability of native prairie stands. Grazing should be delayed until the year after the first seed set if possible. However, leaving forage too long before grazing can encourage the development of ergot, a fungal disease that causes abortions in cattle.

Burning is the best way to eliminate heavy litter that builds up in moist prairie areas. Excess litter chokes out new growth by creating barriers to light, and sometimes by producing chemical inhibitors. Introduced weeds may become established in these spaces if cor-

rective measures are not taken (Gerling, personal observation). Enough fuel usually accumulates in two to three years to carry a prescribed burn. Many native species flower and produce seed more prolifically following fire (Daubenmire 1968; Gerling et al. 1995). Burning during dry periods should be avoided as it can damage the grassland (Redmann et al. 1993).

Grasshoppers can cause failure of native plantings in the dry mixed grass prairie. Hot dry conditions increase rate of egg-laying and development. Preferred egg-laying sites are sandier soils that are bare or have been disturbed. Grasshoppers can be deterred by planting non-preferred crops such as oats in strips 100 m or wider around newly planted areas. Alternatively, “traps” of preferred crops such as fall rye can be planted around reclaimed areas, and a carefully timed application of insecticide can control grasshopper outbreak (Ducks Unlimited 1995). The sooner good ground cover, including litter is re-established on sites, the less attractive the area becomes to grasshoppers.

8.0 WATERCOURSE CROSSINGS AND WETLAND RESTORATION

Native wetlands and riparian (flood plains along streams and rivers) areas are important as buffer systems between upland areas and water drainages such as streams and rivers. They provide important wildlife habitats. These areas act as a filtering and water storage system and reduce erosion. Diverse native vegetation protects the banks of streams and rivers and traps sediment. Well-vegetated streams maintain better water depths and moderate water temperatures, keys to fish survival (Adams and Fitch 1995).

Watercourses and wetlands are often crossed by linear disturbances. In recent years, it has become possible to directionally drill some pipeline crossings. The decision to do this can be influenced by soil and slope stability on either side of the water-crossing, the size of the crossing and the pipe, time of year (fisheries concerns), and cost.

Sometimes an open cut is required to cross the waterbody. Care has to be taken to prevent sediment from affecting fish spawning activities. For this reason, crossings are often not allowed during the period when this is likely to occur. In addition, special mea-

asures are taken to prevent siltation. Diversion ditches and berms can be used to direct water away from the construction area to naturally vegetated areas for sedimentation. Filter cloths (geotextiles) or gravel layers can be placed on erodable banks.

Native vegetation is re-established as quickly as possible. Banks are rebuilt to prevent erosion of back-fill and recreate fish habitat (CAPP 1993). Vertical or overhanging cribwalls can be installed where stream-banks have been disturbed by construction and where fish habitat needs to be restored or enhanced. Bioengineering techniques, e.g. the use of native shrubs, cuttings, live stakes or brush layering, can be used to minimize bank erosion, provide shade and improve aesthetics (CAPP 1993).

In areas where erosion is not a concern, e.g. peatlands, natural revegetation is generally the most successful and least expensive means of vegetating a wetland site (U.S.D.A., 1992). Plant propagules of desired species should be present at, or near the site. If planting is undertaken, adjacent areas are examined to determine suitable species. Diverse plantings allow multiple uses and maximum stability. Revegetated areas should be protected from grazing until they are well established, and rotationally grazed thereafter.

For sites in southern Alberta, there is a comprehensive reference on classification and management of riparian and wetland sites, available from the University of Montana (Hansen et al. 1995) that project managers may find useful.

9.0 REFORESTATION

In the forested areas of Alberta, reforestation is required on large disturbed areas such as cut-blocks in Forest Management Agreement (FMA) areas and on reclaimed mines. On smaller sites in timber producing areas, e.g. wellsites and pipelines, trees are only planted if the age of the surrounding stand is less than 20 years older than the newly replanted area (Sam Takyi, personal communication). If the difference in age is greater than this, the area cannot be harvested in the future as a unit. The Alberta Regeneration Survey Manual (1993) outlines requirements for acceptable establishment and performance of trees in reforested parts of FMAs.

Where wildlife habitat is an integral part of end land use, biodiversity is very important. Natural recovery can work for small disturbances. Trees like poplar sucker onto the reclaimed area, while conifers reseed naturally if the site is less than two hundred metres wide. Placement of slash over disturbed areas can provide a seed source as well as erosion control. On larger areas, structural diversity may have to be recreated by revegetating with grasses, forbs, shrubs and trees.

Site preparation for seeding conifers following timber removal, involves scarification with anchor chains or other equipment to ensure that the seed has contact with mineral soil. On reclamation sites, the leaf litter (duff) is usually mixed with the mineral soil during construction. The leached (Ae) layer present in many forest soil profiles in Alberta can cause difficulties for tree seedling survival if it is very thick (Steve Ferdinand, personal communications). Seeding rates vary with end land use. Timber producing areas are seeded at a rate of one pound/ha of bulk seed (lodgepole pine/spruce). This represents some 80,000 seeds, of which 800 can be expected to establish and mature.

When tree plugs are used, they are usually two years old. The use of larger, older tree or shrub plugs may be necessary on sites where grasses/forbs have been previously planted for erosion control. A thick stand of grass outcompetes small tree or shrub seedlings. Pieces of sod can be removed and the woody material planted in the depression or, in moist areas, planted on top of the inverted sod (Deanna McCullough, personal communication). Competition from grasses is also lessened if care is taken to select the appropriate native species, and seed them at the lowest rate that will control erosion. Native *Calamagrostis* species should not be seeded in forested areas. These species tend to proliferate naturally following disturbance, dominating sites and making it difficult to re-establish trees (Sam Takyi, personal communication). Generally, grass seeding should be avoided where possible.

In the chinook zone along the foothills, snow mold can be a big killer of tree seedlings (Steve Ferdinand, personal communication). Care has to be taken not to leave trenches or ruts where snow sits longer.

10.0

ASSESSING THE SUCCESS
OF REVEGETATION

The main revegetation objective that must be met for any reclamation or restoration project is the creation of a sustainable native ecosystem. This ecosystem should meet the following criteria:

- Control of soil erosion by wind and water,
- Soil building capacity,
- Sustainable growth of vegetation, and
- Compatibility with surrounding vegetation and adjacent land use.

If these four criteria are met, then it may be reasonable to assume that many other important land management goals are also achieved. Some of these objectives include:

- Provision of sustainable grazing for domestic livestock,
- Provision of food and cover for wildlife,
- Protection of watersheds from soil erosion or excess nutrient input,
- Creation of aesthetically pleasing landscapes, and
- Maintenance of biodiversity.

When evaluating the success of revegetation for industrial sites, indicators in the following sections can be used. Please note that these indicators are based on preliminary research. Further experimentation is required to determine what constitutes successful revegetation for different types of disturbances in various natural environments.

10.1 Erosion Prevention Indicators:

- Presence of sufficient ground cover (live plants and litter) and density of plants to prevent erosion and promote infiltration of water. This varies according to the soil type, climate and topography. In the foothills fescue grassland, for example, water erosion begins if ground cover of live plants and litter declines below 85% (Anne Naeth, personal communication). On sandy areas in mixed grass prairie, wind erosion can usually be prevented if ground cover of at least 50% live plants and 25% litter is present (David Walker, personal communication).
- Patches of exposed soil do not exceed those found on adjacent sites in either frequency, distribution, or size (unless left for a specific reason).

10.2 Soil Building Capacity

- Presence of species that promote the formation of a desired soil type, e.g. on grasslands, soil development is promoted by presence of fibrous, deep rooted perennial grasses and legumes.

**10.3 Sustainability of
Vegetation Indicators:**

- Healthy, vigorous growth above ground with no evidence of plant disease or stress that affects sustainability of the vegetation or the health of grazing or browsing animals.
- On grasslands, mature plants that are able to survive grazing pressure must be present. As a guideline, it is suggested that grazing be delayed until the year following the first seed set.
- Evidence of establishment of long-lived perennial native species in the under-story, in cases where short-lived species have been planted for erosion control.
- Presence of a healthy root system, with no evidence of stress due to contamination, disease or compaction. Indicators of stress include: root mats or bunches, flattened roots, absence of roots or uneven distribution within or below reclaimed soils.

**10.4 Compatibility of
Vegetation Indicators:**

- The presence of preferred species, representative of the natural region, growing on the reclaimed area, demonstrating that the existing or proposed end land use can be sustained, e.g. grazing, wildlife habitat.
- Noxious/restricted weeds are absent.
- Invasive introduced species, e.g. brome, clovers, crested wheat grass, reed canary grass and creeping red fescue, etc. are not present.
- Species diversity has been maximized, e.g. a variety of plant forms/species are present or the potential exists for invasion by other native species in the area.

11.0 PRODUCING NATIVE SEED/PLANTS

More people are becoming interested in producing native seed or plants for sale. In preparation for doing this, prospective growers are advised to plan well ahead of time. At least three years lead time is recommended for most species. The following guidelines apply mainly to the production of grasses and forbs.

11.1 Planning Phase

The characteristics and requirements of targeted species and market possibilities must be carefully researched. It is recommended that the prospective grower choose species that are among those present in the same ecoregion he or she lives in. Current growers should be visited; a great deal can be learned from their experiences. Ideally, a market for the seed or plants should be found prior to spending a lot of time, money and energy in establishing a business.

The land should be assessed for weed problems. Soil testing is recommended to determine fertility status, texture, etc. Ideal locations have a sandier textured, weed free soil; are slightly elevated to prevent flooding; are sheltered from prevailing winds, and have good access to water (Morgan et al. 1995).

Several years of weed control are recommended prior to seeding native grasses or forbs. For example, if native grasses will be seeded in three years time, then a crop like canola should be grown in year one, with control for species like quackgrass. The area would be summer-fallowed if possible in year two and again treated for weeds.

Conversely, if native forbs will be planted in three years time, then a crop like oats or barley can be grown in year one, with control for broad-leaved weeds. Care has to be taken not to use herbicides that leave residues in the soil. The area would be summerfallowed in year two with weed control, and planted with forbs the following year.

Time has to be allowed for collection of wild seed or cuttings if required. If the use of a cultivar is planned, time has to be spent locating a clean supply

of suitable seed; be sure to obtain a certificate of seed analysis. Better yet, inspect the fields of the grower that the seed is purchased from.

11.2 Establishment Phase

It is very important to know the percent of Pure Live Seed (PLS) of the seed to be used, since it affects the amount of seed that must be collected or purchased. Wild seed has a PLS substantially less than native cultivars, since the latter are bred to improve germinability. Every generation of selection improves germination.

Most grasses are seeded at a rate of 4 to 6 lb PLS/acre; while forbs are seeded heavier, up to 10 to 15 lb PLS/acre. Row spacing will depend on the climate and soils of the area, as well as species characteristics. In drier areas, rows are planted further apart, to reduce competition for moisture. In areas where soil moisture is good, narrow spacing between rows becomes mandatory to reduce weed competition. Rhizomatous species are planted further apart, e.g. 1 to 1.3 m for western wheat grass, since the stand will close in.

Many forbs are difficult to establish, some with germination and survival rates as low as 5%. For this reason, many producers chose to start "difficult-to-grow" forbs in the greenhouse and transplant them outside once they are established. A sterile starter mix should be used. Most seed should not be covered or only very lightly. Granite grit works well as a light cover and allows light transmission (Rob Staniland, personal communication). The planters should be covered with plastic to retain moisture. Legumes should be scarified first and planted immediately afterwards. Row cropping for forbs is considered essential by many producers to permit mechanical weed control, since there are no herbicides that can be used.

Trees and shrubs are started from seed or cuttings in nurseries and moved outside after they are well established in plugs or other containers. Cuttings should be obtained from the elevation that corresponds to their new environment. Many native trees and shrubs have double dormancy, that is, they do not germinate until the second year. They seem to require a long exposure to cool, damp conditions. One to two years are required for production of suitably sized seedlings.

11.3 Care and Expectations

Irrigation may be required in dry areas to establish plants. Weed control is the biggest challenge for most native plant producers. This is made easier if preparation of the seeded area is thorough. Grass stands can be treated with herbicides but forbs cannot.

Many native grass stands generally have a short seed production life; three years is average. Bunch types last longer than rhizomatous species, which become sod-bound quite quickly. However, seed production for rhizomatous species can often be extended by burning the fields. Holzworth et al. (1990) suggest cultivation in two directions following harvest to prevent formation of a dense sod by northern and western wheat grass plants.

12.0 LOOKING TOWARD THE FUTURE

The increased use of native species helps to ensure that Alberta's biodiversity and endangered landscapes are not lost. It is important that existing natural landscapes be conserved; they are the benchmarks for any restoration effort and an invaluable source of genetic material. Increasing the understanding of the structure and functioning of native communities will help future efforts to restore them.

Researchers can help restoration and reclamation efforts by examining basic ecology of native species; gathering information about everything from seed storage to germination; how, when and where to plant; learning about the relationships among plants, and between them, and their environment. Don Gayton, author of the Wheatgrass Mechanism, points out that, "Some patterns may turn out to be truly random assemblages, but most probably will not....Somewhere in our cluttered human awareness there is a receptor for these patterns, telling us quietly that they need to be looked upon."²

Basic information about plant densities in various natural communities must be collected, since it is necessary information for designing seed mixes. Experimentation with different seed mixes and research on

alternate revegetation methods will give a much better idea of how the stage can be set for healing to take place on disturbed natural landscapes.

It is important that all of those involved in researching and using native plants communicate their findings. We encourage you to pass on your experiences to the authors. We stand at the threshold...

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² Don Gayton. 1990. *The Wheatgrass Mechanism: Science and Imagination in the Western Canadian Landscape*. Fifth House Publishers, Saskatoon, Saskatchewan. p. 14.

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SECTION 2

vegetation communities for the natural regions of alberta



GERALD HAEKEL



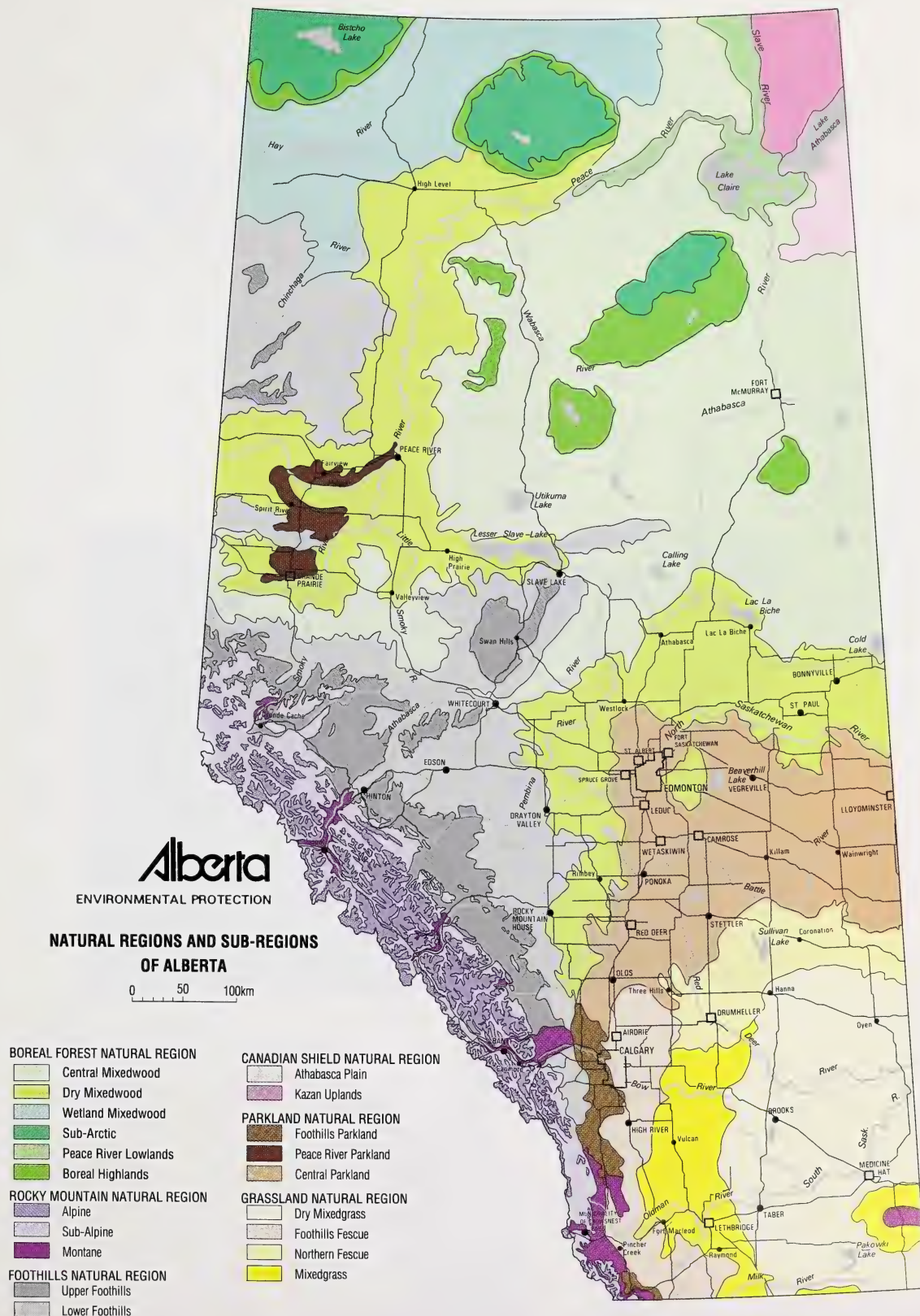
Notes on Section Two: Vegetation Communities

The vegetation community types listed in Section 2 are general lists of species by moisture regime for each subregion. Listed species are the most common representatives for the respective site type under average conditions. Percent cover values and successional status are also representative of only average climax conditions. For a more detailed list of species and community types please refer to the references given at the end of this section.

Native seed usually available in commercial quantity ($>100\text{kg}$) is presented following each community description. Species listed are only those relevant to the respective community. Commercially available seed is based on a 1994 questionnaire to Alberta seed suppliers with a 1995 update. For additional seed/plant availability information see Section 3. Availability of native seed changes constantly. Users are advised to contact seed suppliers directly for current information.

P-PE refers to the potential evapotranspiration deficits/surpluses during the growing season. A negative value for example, indicates more evapotranspiration occurs during the growing season than precipitation.





PART I

grassland
NATURAL REGION



GERALD HAEKEL



1.1



DRY MIXED GRASS AND MIXED GRASS SUBREGIONS

But this ocean is one of grass and the shores are the crests of mountain ranges, and the dark pine forests of the sub-Arctic regions. The great ocean itself does not present more infinite variety than does this prairie-ocean of which we speak.

William Butler, *The Great Lone Land* (1924)

1.1.1

SUBXERIC GRASSLAND

COMMUNITY NAME: needle and thread - blue grama grass

CLIMAX COMMUNITY DESCRIPTION (ungrazed):

**VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
needle and thread grass (<i>Stipa comata</i>)	L	20	pasture sagewort (<i>Artemisia frigida</i>)	E	5
blue grama grass (<i>Bouteloua gracilis</i>)	L	19	moss phlox (<i>Phlox hoodii</i>)	E	3
northern wheat grass (<i>Agropyron dasystachyum</i>)	E	19	scarlet globe mallow (<i>Sphaeralcea coccinea</i>)	E	2
june grass (<i>Koeleria macrantha</i>)	E	18	creeping/tufted white prairie asters (<i>Aster falcatus/ericoides</i>)	E	T
blunt/dryland/Douglas sedges (<i>Carex obtusata/stenophylla/douglasii</i>)	E	5	hairy golden aster (<i>Heterotheca villosa</i>)	E	T
western wheat grass (<i>Agropyron smithii</i>)	E	3	Missouri goldenrod (<i>Solidago missouriensis</i>)	E	T
Sandberg bluegrass (<i>Poa sandbergii</i>)	E	3	slender milk vetch (<i>Astragalus flexuosus</i>)	E	T
thread-leaved sedge (<i>Carex filifolia</i>)	L	2	bee plant (<i>Cleome serrulata</i>)	E	T
plains reed grass (<i>Calamagrostis montanensis</i>)	L	1	annual sunflower (<i>Helianthus annuus</i>)	E	T
six-weeks fescue (<i>Vulpia octoflora</i>)	E	T			
squirreltail (<i>Sitanion hystrix</i>)	E	T	SHRUBS		
FORBS			silver sagebrush (<i>Artemisia cana</i>)	E	5
little club-moss (<i>Selaginella densa</i>)	L	50	brittle prickly pear (<i>Opuntia fragilis</i>)	E	1
			Nuttall's saltbush (<i>Atriplex nuttallii</i>)	L	T

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts**CLIMATE**

- The driest and warmest part of Alberta
- Droughts are frequent and a primary limiting factor in revegetation
- Intense thunder storms can result in spectacular water erosion
- Strong winds occur with high frequency resulting in erosion problems in reclamation sites
- There is seldom good snow cover through the winter, aggravating survival of reclamation seedlings
- Growing season P-PE = -350 to -400 mm

SOILS AND LANDSCAPES

- landscapes are typically morainal (thin to thick)
- soil profile depth is typically between 25 and 40 cm with 5 to 10 cm of brown colored top soil
- soils are mostly Chernozemic but Solonchic soils and other salt-affected soils are significant

SOIL RECLAMATION ISSUES

- very thin top soil, which is often discontinuous and difficult to salvage
- wind erosion during and after construction
- drought limiting revegetation success
- salt-affected soils often require special handling and impedes revegetation

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

• western wheat grass	(<i>Agropyron smithii</i>)
• northern wheat grass	(<i>Agropyron dasystachyum</i> var. <i>dasystachyum</i>)
• june grass	(<i>Koeleria macrantha</i>)
• needle and thread grass	(<i>Stipa comata</i>)
• blue grama grass	(<i>Bouteloua gracilis</i>)

1.1.2

MESIC GRASSLAND**COMMUNITY NAME:** needle and thread - blue grama grass - wheat grass**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
needle and thread grass (<i>Stipa comata</i>)	L	30	creeping/tufted white prairie asters (<i>Aster falcatus/ericoides</i>)	E	T
northern wheat grass (<i>Agropyron dasystachyum</i>)	L	10	scarlet butterfly-weed (<i>Gaura coccinea</i>)	E	T
june grass (<i>Koeleria macrantha</i>)	E	10	death camas (<i>Zigadenus venenosus</i>)	E	T
blue grama grass (<i>Bouteloua gracilis</i>)	L	7	narrow-leaved/slender milk vetches (<i>Astragalus pectinatus/flexuosus</i>)	E	T
dryland/blunt/sun-loving sedges (<i>Carex stenophylla/obtusata/pensylvanica</i>)	E	7	purple/white prairie clover (<i>Petalostemon purpureum/candidum</i>)	L	T
western porcupine grass (<i>Stipa curtisetia</i>)	L	5	shining/twin arnica (<i>Arnica fulgens/sororia</i>)	E	T
western wheat grass (<i>Agropyron smithii</i>)	L	5	blazing star (<i>Liatris punctata</i>)	E	T
plains reed grass (<i>Calamagrostis montanensis</i>)	E	5	late/early loco-weed (<i>Oxytropis monticola/sericea</i>)	E	T
Sandberg bluegrass (<i>Poa sandbergii</i>)	E	2	blue lettuce (<i>Lactuca pulchella</i>)	E	T
green needle grass (<i>Stipa viridula</i>)	E	T	scarlet globe mallow (<i>Sphaeralcea coccinea</i>)	E	T
slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>trachycaulum</i>)	E	T	yellow evening primrose (<i>Oenothera biennis</i>)	E	T
sweet grass (<i>Hierochloa odorata</i>)	E	T	cut-leaved anemone (<i>Anemone multifida</i>)	E	T
early bluegrass (<i>Poa cusickii</i>)	E	T	old man's whiskers (<i>Geum triflorum</i>)	E	T
FORBS			wild licorice (<i>Glycyrrhiza lepidota</i>)	E	T
little club-moss (<i>Selaginella densa</i>)	L	50	annual sunflower (<i>Helianthus annuus</i>)	E	T
moss phlox (<i>Phlox hoodii</i>)	E	5	prairie cone flower (<i>Ratibida columnifera</i>)	E	T
pasture sagewort (<i>Artemisia frigida</i>)	E	3	SHRUBS		
American vetch (<i>Vicia sparsifolia</i>)	E	1	winter fat (<i>Eurotia lanata</i>)	L	5
prairie crocus (<i>Anemone patens</i>)	E	T	silver sagebrush (<i>Artemisia cana</i>)	E	T
broomweed (<i>Gutierrezia sarothrae</i>)	E	T	thorny buffalo-berry (<i>Shepherdia argentea</i>)	E	T
golden bean (<i>Thermopsis rhombifolia</i>)	E	T	prairie rose (<i>Rosa arkansana</i>)	E	T
spiny iron plant (<i>Haplopappus spinulosus</i>)	E	T			

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts**CLIMATE**

- Not as dry as 1.1 subxeric grassland and growing season is short
- Poor snow cover may increase mortality and limit winter survival of seedlings
- Growing season P-PE= -250 to -350 mm

SOILS AND LANDSCAPES

- landscapes are typically morainal
- soil profile depth can extend to 50 cm with the A horizon typically exceeding 10 cm
- soils are predominantly Chernozemic with some Solonchic soils occurring throughout

SOIL RECLAMATION ISSUES

- wind erosion problems are key concerns especially on sandy textured soils
- water erosion problems may occur in this higher precipitation grassland
- establishing vegetation cover can be difficult in drier areas or drought years

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- western wheat grass
- northern wheat grass
- slender wheat grass
- june grass
- needle and thread grass
- green needle grass
- blue grama grass

(*Agropyron smithii*)
 (*Agropyron dasystachyum* var. *dasystachyum*)
 (*Agropyron trachycaulum* var. *trachycaulum*)
 (*Koeleria macrantha*)
 (*Stipa comata*)
 (*Stipa viridula*)
 (*Bouteloua gracilis*)

1.1.3

MIXED GRASS SOLONETZIC SITES

COMMUNITY NAME: needle and thread - western wheat grass

CLIMAX COMMUNITY DESCRIPTION (ungrazed):

**VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS		
needle and thread grass (<i>Stipa comata</i>)	L	30	little club-moss (<i>Selaginella densa</i>)	L	30
northern wheat grass (<i>Agropyron dasystachyum</i>)	L	15	pasture sagewort (<i>Artemisia frigida</i>)	E	5
june grass (<i>Koeleria macrantha</i>)	E	15	moss phlox (<i>Phlox hoodii</i>)	E	T
blue grama grass (<i>Bouteloua gracilis</i>)	L	10	scarlet globe mallow (<i>Sphaeralcea coccinea</i>)	E	T
western wheat grass (<i>Agropyron smithii</i>)	L	5	golden bean (<i>Thermopsis rhombifolia</i>)	E	T
Sandberg bluegrass (<i>Poa sandbergii</i>)	E	3	gumweed (<i>Grindelia squarrosa</i>)	E	T
blunt/dryland/Douglas sedges (<i>Carex obtusata/stenophylla/douglasii</i>)	E	2	Missouri goldenrod (<i>Solidago missouriensis</i>)	E	T
plains reed grass (<i>Calamagrostis montanensis</i>)	E	1	annual sunflower (<i>Helianthus annuus</i>)	E	T
alkali bluegrass (<i>Poa juncifolia</i>)	E	T	poverty weed (<i>Iva axillaris</i>)	E	T
Nuttall's alkali grass (<i>Puccinellia nuttalliana</i>)	E	T	SHRUBS		
Canby bluegrass (<i>Poa canbyi</i>)	E	T	Nuttall's atriplex (<i>Atriplex nuttallii</i>)	L	5
			silver sagebrush (<i>Artemisia cana</i>)	E	T

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts**CLIMATE**

- All areas in mixed grass prairie with Solonetzic soils from subxeric to mesic
- Droughts are frequent and limit revegetation
- Water erosion associated with thunder storms
- Inadequate snow cover may increase winter kill or reclamation seedlings
- Growing season P-PE= -250 to -400 mm

SOILS AND LANDSCAPES

- Solonetzic soils throughout the Brown Soil Zone but also into Dark Brown Soil Zone especially Hanna area and into soils correlation area #3
- the A horizon variable in depth and subject to wind erosion

SOIL RECLAMATION ISSUES

- wind erosion problems can occur during and after construction
- wind-eroded soils may require special handling
- revegetation difficulties due to drought and soils can frequently be expected

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

• northern wheat grass	(<i>Agropyron dasystachyum</i>)
• western wheat grass	(<i>Agropyron smithii</i>)
• june grass	(<i>Koeleria macrantha</i>)
• Nuttall's alkali grass	(<i>Puccinellia nuttalliana</i>)
• needle and thread grass	(<i>Stipa comata</i>)
• blue grama grass	(<i>Bouteloua gracilis</i>)

1.1.4

MIXED GRASS SALINE SITES

COMMUNITY NAME: salt grass - western wheat grass - foxtail barley

CLIMAX COMMUNITY DESCRIPTION (ungrazed):



VEGETATION COMMUNITY		
SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE		
western wheat grass (<i>Agropyron smithii</i>)	L	40
salt grass (<i>Distichlis stricta</i>)	L	10
Nuttall's alkali grass (<i>Puccinellia nuttalliana</i>)	L	10
alkali bluegrass (<i>Poa juncifolia</i>)	L	5
Sandberg bluegrass (<i>Poa sandbergii</i>)	E	5
Canby bluegrass (<i>Poa canbyi</i>)	E	T
foxtail barley (<i>Hordeum jubatum</i>)	L	T
FORBS		
gumweed (<i>Grindelia squarrosa</i>)	E	5
SPECIES	*	% CANOPY COVER
FORBS continued		
poverty weed (<i>Iva axillaris</i>)	E	T
tufted white prairie aster (<i>Aster ericoides</i>)	E	T
sea-blite (<i>Suaeda calceoliformis</i>)	E	T
samphire (<i>Salicornia rubra</i>)	E	T
annual sunflower (<i>Helianthus annuus</i>)	E	T
SHRUBS		
greasewood (<i>Sarcobatus vermiculatus</i>)	E	10
Nuttall's atriplex (<i>Atriplex nuttallii</i>)	L	T

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts**CLIMATE**

- All areas within the mixed grass prairie with moisture conditions subxeric to mesic
- Droughts are frequent and limit revegetation
- Wind erosion a major concern on these sites along with water erosion associated with thunder storms
- Growing season P-PE= -250 to -400 mm

SOILS AND LANDSCAPES

- soils are Brown and Dark Brown Chernozems, Gleysols, Regosols, with some Solonchets soils associated generally with saline parent materials
- salts associated with discharge may be significant

SOIL RECLAMATION ISSUES

- salt-affected soils often require special handling
- wind erosion of topsoil in stock piles and travel areas
- revegetation can be affected by salts and drought

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- western wheat grass
- Nuttall's alkali grass

(*Agropyron smithii*)
(*Puccinellia nuttalliana*)

1.1.5

MIXED GRASS REGOSOLIC SITES AND DUNES**COMMUNITY NAME:** sand grass - Indian rice grass - western wheat grass**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
sand grass (<i>Calamovilfa longifolia</i>)	L	DNA	white evening primrose (<i>Oenothera nuttallii</i>)	E	DNA
western wheat grass (<i>Agropyron smithii</i>)	L	DNA	prairie rocket (<i>Erysimum asperum</i>)	E	DNA
Indian rice grass (<i>Oryzopsis hymenoides</i>)	L	DNA	prairie cinquefoil (<i>Potentilla pensylvanica</i>)	E	DNA
needle and thread (<i>Stipa comata</i>)	L	DNA	horse weed (<i>Erigeron canadensis</i>)	E	DNA
Canada wild rye (<i>Elymus canadensis</i>)	E	DNA	hairy golden aster (<i>Heterotheca villosa</i>)	E	DNA
sand dropseed (<i>Sporobolus cryptandrus</i>)	E	DNA	blazing star (<i>Liatris punctata</i>)	E	DNA
blunt sedge (<i>Carex obtusata</i>)	E	DNA	golden bean (<i>Thermopsis rhombifolia</i>)	E	DNA
early bluegrass (<i>Poa cusickii</i>)	E	DNA	Missouri goldenrod (<i>Solidago missouriensis</i>)	E	DNA
Hooker's oat grass (<i>Helictotrichon hookeri</i>)	E	DNA	alum-root (<i>Heuchera richardsonii</i>)	E	DNA
plains reed grass (<i>Calamagrostis montanensis</i>)	E	DNA			
FORBS			SHRUBS		
wild licorice (<i>Glycyrrhiza lepidota</i>)	E	DNA	creeping juniper (<i>Juniperus horizontalis</i>)	L	DNA
scurf pea (<i>Psoralea lanceolata</i>)	E	DNA	prairie rose (<i>Rosa arkansana</i>)	E	DNA
skeleton-weed (<i>Lygodesmia juncea</i>)	E	DNA	buckbrush (<i>Symphoricarpos occidentalis</i>)	E	DNA
wild begonia (<i>Rumex venosus</i>)	E	DNA	prickly pear (<i>Opuntia polyacantha</i>)	E	DNA
bee plant (<i>Cleome serrulata</i>)	E	DNA			
narrow-leaved goosefoot (<i>Chenopodium pratericola</i>)	E	DNA			

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** DNA = data not available**CLIMATE**

- All areas within the mixed grass prairie with moisture conditions subxeric to mesic
- Droughts are frequent and limit revegetation
- Wind erosion is the major concern on these sites
- Water erosion on steep topography
- Internal and/or surface drainage tends to be rapid

SOILS AND LANDSCAPES

- soils are Regosols throughout the Brown and Dark Brown soil zones
- little A horizon development
- includes sand dune areas
- also on steep river or coulee breaks

SOIL RECLAMATION ISSUES

- wind erosion on sandy soils a primary concern during construction and after
- steep slopes create significant water erosion potential
- revegetation difficult due to droughts in this area as well as the rapid internal drainage or conversely surface drainage
- surface mulching frequently essential

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY

- Indian rice grass
- western wheat grass
- Canada wild rye
- sand grass
- needle and thread grass

(*Oryzopsis hymenoides*)
 (*Agropyron smithii*)
 (*Elymus canadensis*)
 (*Calamovilfa longifolia*)
 (*Stipa comata*)

1.2



FOOTHILLS FESCUE SUBREGION

*Wilderness is the raw material out of which man has
hammered the artifact called civilization....*

*The rich diversity of the world's cultures
reflects a corresponding diversity in the
wilds that gave them birth.*

Aldo Leopold, A Sand County Almanac (1966)

1.2.1

SUBMESIC GRASSLAND (UPPER SLOPE POSITIONS)**COMMUNITY NAME:** Parry oatgrass - rough fescue - sedge**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE		
Parry oat grass (<i>Danthonia parryi</i>)	L	23
rough fescue (<i>Festuca campestris</i>)	L	15
awned/slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale</i> / <i>trachycaulum</i>)	E	15
blunt/dryland sedge (<i>Carex obtusata</i> / <i>stenophylla</i>)	L	12
green needle grass (<i>Stipa viridula</i>)	E	5
plains reed grass (<i>Calamagrostis montanensis</i>)	E	5
purple reed grass (<i>Calamagrostis purpurascens</i>)	E	5
early blue grass (<i>Poa cusickii</i>)	E	4
Idaho fescue (<i>Festuca idahoensis</i>)	E	3
june grass (<i>Koeleria macrantha</i>)	E	2
bluebunch wheat grass (<i>Agropyron spicatum</i>)	E	2
northern wheat grass (<i>Agropyron dasystachyum</i>)	L	2
FORBS		
moss phlox (<i>Phlox hoodii</i>)	E	10
little club moss (<i>Selaginella densa</i>)	L	6
cut-leaved anemone (<i>Anemone multifida</i>)	E	3
American/northern sweet vetches (<i>Hedysarum alpinum/boreale</i>)	E	3

SPECIES	*	% CANOPY COVER
FORBS <i>continued</i>		
stone-seed (<i>Lithospermum ruderale</i>)	L	3
blanket flower (<i>Gaillardia aristata</i>)	E	2
nodding onion (<i>Allium cernuum</i>)	E	1
alum-root (<i>Heuchera cylindrica</i>)	E	1
wild blue flax (<i>Linum lewisii</i>)	E	1
hairy golden aster (<i>Heterotheca villosa</i>)	E	T
smooth blue beard-tongue (<i>Penstemon nitidus</i>)	E	T
white/purple prairie clovers (<i>Petalostemon candidum/purpureum</i>)	E	T
milk vetches (<i>Astragalus aboriginum</i> / <i>crassicaupus/tenellus/missouriensis</i>)	E	T
prairie cone flower (<i>Ratibida columnifera</i>)	E	T
loco-weeds (<i>Oxytropis sericea</i> / <i>splendens/viscida</i>)	E	T
annual sunflower (<i>Helianthus annuus</i>)	E	T
SHRUBS		
shrubby cinquefoil (<i>Potentilla fruticosa</i>)	E	5
prickly rose (<i>Rosa acicularis</i>)	E	3
creeping juniper (<i>Juniperus horizontalis</i>)	L	2
buckbrush (<i>Symphoricarpos occidentalis</i>)	E	1

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts

CLIMATE

- The agroclimate varies from slight, in the south, to severe heat limitations farther north or at higher elevations
- Temperatures are cooler and more precipitation is received during the growing season
- Topography and exposure increase surface drying, resulting in frequent moisture deficits
- Accumulation of snow is usually short-lived due to chinook activity

SOILS AND LANDSCAPES

- soils are thin Black Chernozems, Orthic Regosols and Orthic Melanic Brunisols
- landforms are highly influenced by underlying rock
- soil profiles are shallow
- landscapes are hummocky rolling to ridged

SOIL RECLAMATION ISSUES

- potential soil erosion by water is generally high to severe although local conditions vary
- wind erosion is a concern due to high velocity chinook winds
- since snow cover is frequently removed by the winds, erosion can occur in any month

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- june grass
- northern wheat grass
- green needle grass
- slender wheat grass
- rough fescue
- bluebunch wheat grass
- Idaho fescue
- wild blue flax
- awned wheat grass

(Koeleria macrantha)
(Agropyron dasystachyum)
(Stipa viridula)
(Agropyron trachycaulum var. trachycaulum)
(Festuca campestris)
(Agropyron spicatum)
(Festuca idahoensis)
(Linum lewisii)
(Agropyron trachycaulum var. unilaterale)

1.2.2

MESIC GRASSLAND (LOWER SLOPE POSITIONS)**COMMUNITY NAME:** rough fescue - Parry oatgrass**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE		
rough fescue (<i>Festuca campestris</i>)	L	32
Parry oat grass (<i>Danthonia parryi</i>)	L	21
awned/slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale</i> / <i>trachycaulum</i>)	E	20
sun-loving/spengel's sedges (<i>Carex pensylvanica</i> / <i>spengelii</i>)	L	17
Richardson needle grass (<i>Stipa richardsonii</i>)	E	6
Idaho fescue (<i>Festuca idahoensis</i>)	L	5
Kentucky bluegrass (<i>Poa pratensis</i>)‡	E	3
Hooker's oat grass (<i>Helictotrichon hookeri</i>)	E	2
sweet grass (<i>Hierochloa odorata</i>)	E	2
plains reed grass (<i>Calamagrostis montanensis</i>)	E	2
june grass (<i>Koeleria macrantha</i>)	E	1
northern wheat grass (<i>Agropyron dasystachyum</i>)	E	1
northern awnless brome (<i>Bromus pumpellianus</i>)	E	1
FORBS		
old man's whiskers (<i>Geum triflorum</i>)	E	14
yellow/slender blue beard-tongue (<i>Penstemon confertus/procerus</i>)	E	13
wild strawberry (<i>Fragaria virginiana</i>)	E	6
graceful cinquefoil (<i>Potentilla gracilis</i>)	E	5
common yarrow (<i>Achillea millefolium</i>)	E	3
sticky purple geranium (<i>Geranium viscosissimum</i>)	L	2

SPECIES	*	% CANOPY COVER
FORBS continued		
American sweet vetch (<i>Hedysarum alpinum</i>)	E	1
harebell (<i>Campanula rotundifolia</i>)	E	1
smooth/showy fleabane (<i>Erigeron glabellus/speciosus</i>)	E	1
northern bedstraw (<i>Galium boreale</i>)	E	1
smooth aster (<i>Aster laevis</i>)	L	1
horse mint (<i>Monarda fistulosa</i>)	E	1
low larkspur (<i>Delphinium bicolor</i>)	E	1
blue-eyed grass (<i>Sisyrinchium montanum</i>)	E	T
false dandelion (<i>Agoseris glauca</i>)	E	T
smooth-leaved cinquefoil (<i>Potentilla diversifolia</i>)	E	T
anemone (<i>Anemone multifida/cylindrica/patens</i>)	E	T
silky/silvery lupines (<i>Lupinus sericeus/argenteus</i>)	E	T
blanket flower (<i>Gaillardia aristata</i>)	E	T
silky scorpion weed (<i>Phacelia sericea</i>)	E	T
Missouri/Canada goldenrods (<i>Solidago missouriensis/canadensis</i>)	E	T
loco-weeds (<i>Oxytropis monticola/sericea/viscida/splendens</i>)	E	T
annual sunflower (<i>Helianthus annuus</i>)	E	T
wild blue flax (<i>Linum lewisii</i>)	E	T
SHRUBS		
prickly rose (<i>Rosa acicularis</i>)	E	3
shrubby cinquefoil (<i>Potentilla fruticosa</i>)	E	2

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species
 ‡ native origins questionable

% **CANOPY COVER:** T = trace amounts

CLIMATE

- The agroclimate varies from slight, in the south, to severe heat limitations farther north or at higher elevations
- Temperatures are cooler and more precipitation is received during the growing season but moisture deficits may occur
- Accumulation of snow occurs but chinook activity may result in periods of moisture deficit
- Growing season P-PE = -150 to -250 mm

SOILS AND LANDSCAPES

- soils are Orthic Black Chernozems and rarely Solonchic
- landforms are highly influenced by underlying bedrock
- soil profile development is 40 to 50 cm deep with 20 to 30 cm of black colored A horizon
- landscapes are undulating to hummocky and rolling

SOIL RECLAMATION ISSUES

- potential soil erosion by water generally ranges from severe to moderate, although local conditions vary widely
- wind erosion is a concern due to the high velocity chinook winds

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slender wheat grass
- northern wheat grass
- rough fescue
- Idaho fescue
- june grass
- awned wheat grass
- wild blue flax

(*Agropyron trachycaulum* var. *trachycaulum*)
 (*Agropyron dasystachyum*)
 (*Festuca campestris*)
 (*Festuca idahoensis*)
 (*Koeleria macrantha*)
 (*Agropyron trachycaulum* var. *unilaterale*)
 (*Linum lewisii*)

1.3



NORTHERN FESCUE SUBREGION

Native prairies provide the mind with a retreat. Often seen only from a distance, reassuring and private places, they are imagined and recalled more often than actually visited. They become places of composure and personal balance, geographies of hope.

Don Gayton, *The Wheatgrass Mechanism* (1990)

1.3.1

SANDY UPLAND SITES**COMMUNITY NAME:** plains rough fescue - sand grass**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE		
plains rough fescue (<i>Festuca hallii</i>)	L	15
sand grass (<i>Calamovilfa longifolia</i>)	L	10
green needle grass (<i>Stipa viridula</i>)	E	10
early bluegrass (<i>Poa cusickii</i>)	E	10
western porcupine grass (<i>Stipa curtisetia</i>)	L	5
blunt/dryland sedge (<i>Carex obtusata/stenophylla</i>)	L	5
june grass (<i>Koeleria macrantha</i>)	E	3
awned wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale</i>)	E	2
Canada wild rye (<i>Elymus canadensis</i>)	E	1
plains reed grass (<i>Calamagrostis montanensis</i>)	E	1
northern wheat grass (<i>Agropyron dasystachyum</i>)	E	1
plains bluegrass (<i>Poa arida</i>)	E	1
western wheat grass (<i>Agropyron smithii</i>)	E	T
Hooker's oat grass (<i>Helictotrichon hookeri</i>)	E	T
needle and thread grass (<i>Stipa comata</i>)	E	T
sweet grass (<i>Hierochloa odorata</i>)	E	T
Indian rice grass (<i>Oryzopsis hymenoides</i>)	E	T
Sand dropseed (<i>Sporobolus cryptandrus</i>)	E	T
sheep fescue (<i>Festuca ovina</i>)†	E	T
sand nut-grass (<i>Cyperus schweinitzii</i>)	E	T

FORBS

pasture sagewort (<i>Artemisia frigida</i>)	E	5
northern wormwood (<i>Artemisia campestris</i>)	E	3
Missouri goldenrod (<i>Solidago missouriensis</i>)	E	2
priarie/white cinquefoils (<i>Potentilla pensylvanica/arguta</i>)	E	2

SPECIES	*	% CANOPY COVER
FORBS <i>continued</i>		
alum-root (<i>Heuchera richardsonii</i>)	E	2
golden bean (<i>Thermopsis rhombifolia</i>)	E	1
skeleton-weed (<i>Lygodesmia juncea</i>)	E	1
prairie rocket (<i>Erysimum asperum</i>)	E	1
narrow-leaved goosefoot (<i>Chenopodium pratericola</i>)	E	1
white evening primrose (<i>Oenothera nuttallii</i>)	E	1
purple rock cress (<i>Arabis divaricarpa</i>)	E	1
bee plant (<i>Cleome serrulata</i>)	E	T
wild begonia (<i>Rumex venosus</i>)	E	T
milk vetches (<i>Astragalus crassicaarpus/dasyglottis/drummondii/flexuosus/striatus</i>)	E	T
wild licorice (<i>Glycyrrhiza lepidota</i>)	E	T
purple pea vine (<i>Lathyrus venosus</i>)	E	T
late/early yellow loco-weed (<i>Oxytropis monticola/sericea</i>)	E	T
purple prairie clover (<i>Petalostemon purpureum</i>)	E	T
silver-leaf psoralea (<i>Psoralea argophylla</i>)	E	T
hairy golden aster (<i>Heterotheca villosa</i>)	E	T
horseweed (<i>Erigeron canadensis</i>)	E	T
blue lettuce (<i>Lactuca pulchella</i>)	E	T
prairie sunflower (<i>Helianthus couplandii</i>)	E	T
prairie sagewort (<i>Artemisia ludoviciana</i>)	E	T

SHRUBS

creeping juniper (<i>Juniperus horizontalis</i>)	L	10
prickly/prairie rose (<i>Rosa acicularis/arkansana</i>)	E	5
buckbrush (<i>Symphoricarpos occidentalis</i>)	E	5
wolfwillow (<i>Elaeagnus commutata</i>)	E	4
ground juniper (<i>Juniperus communis</i>)	L	T

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species% **CANOPY COVER:** T = trace amounts

† native origins questionable

CLIMATE

- The agroclimate has slight to moderate heat limitations
- Snow cover tends to persist throughout the winter because of cooler temperatures and infrequent influence of chinooks
- July is generally the wettest month
- Internal drainage of the sandy soils results in these sites being more drought-prone than adjoining sites with heavier soils
- Growing season P-PE = -200 to -300 mm

SOILS AND LANDSCAPES

- soils are predominantly sandy Chernozems with some Regosols (Dark Brown Chernozems)
- undulating Glaciolacustrine and Glaciofluvial deposits are dominant landforms frequently modified by eolian action

SOIL RECLAMATION ISSUES

- potential risk of soil erosion by wind is high to severe
- the risk of soil erosion by water generally low although the risk will vary with local conditions
- extended dry periods produce seed "burnout"
- reseed only when moisture levels are favorable or during dormant period in the fall.
- poor reseeding months (July - August)

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- northern or western wheat grass
- awned wheat grass
- june grass
- sand grass
- Canada wild rye
- green needle grass
- plains rough fescue
- needle and thread grass
- Indian rice grass
- sheep fescue

(*Agropyron dasystachyum* or *smithii*)
 (*Agropyron trachycaulum* var. *unilaterale*)
 (*Koeleria macrantha*)
 (*Calamovilfa longifolia*)
 (*Elymus canadensis*)
 (*Stipa viridula*)
 (*Festuca hallii*)
 (*Stipa comata*)
 (*Oryzopsis hymenoides*)
 (*Festuca ovina*)

1.3.2

MESIC GRASSLAND**COMMUNITY NAME:** plains rough fescue - western porcupine grass**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
plains rough fescue (<i>Festuca hallii</i>)	L	60	blue lettuce (<i>Lactuca pulchella</i>)	E	2
western porcupine grass (<i>Stipa curtisetia</i>)	L	20	golden bean (<i>Thermopsis rhombifolia</i>)	E	1
blunt/sun-loving sedge (<i>Carex obtusata/pennsylvanica</i>)	L	10	creeping/tufted white prairie asters (<i>Aster falcatus/ericoides</i>)	E	1
green needle grass (<i>Stipa viridula</i>)	E	10	pasture sagewort (<i>Artemisia frigida</i>)	E	1
sweet grass (<i>Hierochloa odorata</i>)	E	5	milk vetches (<i>Astragalus striatus/dasyglottis/flexuosus/drummondii/crassicarpus</i>)	E	1
Rocky mountain fescue (<i>Festuca saximontana</i>)	E	3	bastard toad-flax (<i>Comandra umbellata</i>)	E	1
june grass (<i>Koeleria macrantha</i>)	E	2	cinquefoils (<i>Potentilla hippiana/pennsylvanica/gracilis</i>)	E	1
northern wheat grass (<i>Agropyron dasystachyum</i>)	E	2	purple pea vine (<i>Lathyrus venosus</i>)	L	1
Hooker's oat grass (<i>Helictotrichon hookeri</i>)	E	2	smooth aster (<i>Aster laevis</i>)	L	T
Kentucky bluegrass (<i>Poa pratensis</i>)‡	E	2	common yarrow (<i>Achillea millefolium</i>)	E	T
awned wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale</i>)	L	2	blue-eyed grass (<i>Sisyrinchium montanum</i>)	E	T
western wheat grass (<i>Agropyron smithii</i>)	E	1	wild blue flax (<i>Linum lewisii</i>)	E	T
slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>trachycaulum</i>)	L	1	smooth fleabane (<i>Erigeron glabellus</i>)	E	T
blue grama grass (<i>Bouteloua gracilis</i>)	L	T	late/early yellow loco-weeds (<i>Oxytropis monticola/sericea</i>)	E	T
FORBS			American/northern sweet vetches (<i>Hedysarum alpinum/boreale</i>)	E	T
little club-moss (<i>Selaginella densa</i>)	L	3	purple prairie clover (<i>Petalostemon purpureum</i>)	E	T
prairie crocus (<i>Anemone patens</i>)	L	2	blanket flower (<i>Gaillardia aristata</i>)	E	T
low/small-leaved everlasting (<i>Antennaria aprica/parvifolia</i>)	E	2	horse mint (<i>Monarda fistulosa</i>)	E	T
prairie sage wort (<i>Artemisia ludoviciana</i>)	E	2	SHRUBS		
Canada/long-fruited anemones (<i>Anemone canadensis/cylindrica</i>)	E	2	buckbrush (<i>Symphoricarpos occidentalis</i>)	E	7
Missouri/stiff goldenrod (<i>Solidago missouriensis/irigida</i>)	E	2	prairie rose (<i>Rosa arkansana</i>)	E	6

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
 ‡ native origins questionable

CLIMATE

- The agroclimate has slight to moderate heat limitations
- Snow cover tends to persist throughout the winter because of cooler temperatures and infrequent influence of chinooks
- July is generally the wettest month
- Growing season P-PE = -150 to -250 mm

SOILS AND LANDSCAPES

- soils are predominantly Black Chernozems with a few Solonetzics
- Chernozemic soils have between 15 and 30 cm of a black colored A horizon which is developed to 65 cm
- the Solonetzic soils are shallower and have less topsoil
- undulating moraine (till) landscapes are the most common with some hummocky areas, and Glaciolacustrine and Glaciofluvial deposits comprise other significant land forms

SOIL RECLAMATION ISSUES

- potential soil erosion by water is generally low although the risk varies with local conditions
- the risk of soil erosion by wind is low to moderate except for sandy-textured areas where it is high
- Solonetzic soils, shallow soils with saline and sodic soft rock, and others with highly saline and sodic subsoils may require special soil handling during stripping and trenching

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slender wheat grass
- awned wheat grass
- northern wheat grass
- green needle grass
- western wheat grass
- Rocky mountain fescue
- june grass
- plains rough fescue
- blue grama grass
- wild blue flax

(*Agropyron trachycaulum* var. *trachycaulum*)
 (*Agropyron trachycaulum* var. *unilaterale*)
 (*Agropyron dasystachyum*)
 (*Stipa viridula*)
 (*Agropyron smithii*)
 (*Festuca saximontana*)
 (*Koeleria macrantha*)
 (*Festuca hallii*)
 (*Bouteloua gracilis*)
 (*Linum lewisii*)

1.3.3

SUBHYGRIC GRASSLANDS**COMMUNITY NAME:** sedge meadows (fresh and saline sites)**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			GRASSES/GRASS-LIKE <i>continued</i>		
FRESH WATER SITES			Baltic rush (<i>Juncus balticus</i>)	E	5
water sedge (<i>Carex aquatilis</i>)	L	50	alkali cord grass (<i>Spartina gracilis</i>)	L	2
awned sedge (<i>Carex atherodes</i>)	L	10			
Baltic rush (<i>Juncus balticus</i>)	E	5	FORBS		
slough grass (<i>Beckmannia syzigachne</i>)	L	5	golden/narrow-leaved dock (<i>Rumex maritimus/triangulivalis</i>)	E	5
beaked sedge (<i>Carex rostrata</i>)	L	5	water hemlock (<i>Cicuta maculata</i>)	E	4
water foxtail (<i>Alopecurus aequalis</i>)	L	3	water parsnip (<i>Sium suave</i>)	E	3
northern reed grass (<i>Calamagrostis inexpansa</i>)	L	2	seaside/slender arrow-grass (<i>Triglochin maritima/palustris</i>)	E	2
narrow-leaved reed grass (<i>Calamagrostis stricta</i>)	L	2	wild mint (<i>Mentha arvensis</i>)	E	2
woolly sedge (<i>Carex lanuginosa</i>)	L	2	mealy primrose (<i>Primula incana</i>)	E	1
tall manna grass (<i>Glyceria grandis</i>)	L	2	western willow aster (<i>Aster hesperius</i>)	E	1
graceful sedge (<i>Carex praegracilis</i>)	E	2	buttercups (<i>Ranunculus sceleratus/cymbalaria/macounii</i>)	E	1
spangle top (<i>Scolochloa festuacea</i>)	E	1	silverweed (<i>Potentilla anserina</i>)	E	1
creeping spike rush (<i>Eleocharis palustris</i>)	E	1	saline shooting star (<i>Dodecatheon pulchellum</i>)	E	1
bluegrasses (<i>Poa palustris/juncifolia/canbyi</i>)	E	T	northern willow herb (<i>Epilobium ciliatum</i>)	E	T
slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>trachycaulum</i>)	E	T	rush aster (<i>Aster borealis</i>)	E	T
SALINE SITES			hedge nettle (<i>Stachys palustris</i>)	E	T
Nuttall's alkali grass (<i>Puccinellia nuttalliana</i>)	L	15			
foxtail barley (<i>Hordeum jubatum</i>)	E	10	SHRUBS		
bulrush (<i>Scirpus acutus/validus/pungens/paludosus</i>)	L	10	willows (<i>Salix bebbiana/petiolaris/dicolor</i>)	E	25
salt grass (<i>Distichlis stricta</i>)	L	5	wild gooseberry (<i>Ribes oxycanthoides</i>)	E	3

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts

CLIMATE

- The agroclimate has slight to moderate heat limitations
- Snow cover tends to persist throughout the winter because of cooler temperatures and infrequent influence of chinooks
- July is generally the wettest month
- Growing season P-PE = -150 to -250 mm

SOILS AND LANDSCAPES	SOIL RECLAMATION ISSUES
<ul style="list-style-type: none"> • soils are predominantly Gleysols • low areas in the undulating and hummocky moraine landscapes or glaciolacustrine deposits 	<ul style="list-style-type: none"> • potential of soil erosion by water can be high • highly saline and sodic subsoils may require special soil handling during stripping and trenching • risk of soil erosion is low except during construction phases, also higher risk in sandy textures

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)	
<ul style="list-style-type: none"> • slough grass • slender wheat grass • Nuttall's alkali grass • spangle top • fowl bluegrass 	<p>(<i>Beckmannia syzigachne</i>)</p> <p>(<i>Agropyron trachycaulum</i> var. <i>trachycaulum</i>)</p> <p>(<i>Puccinellia nuttalliana</i>)</p> <p>(<i>Scolochloa festucacea</i>)</p> <p>(<i>Poa palustris</i>)</p>

1.3.4

SOLONETZIC SITES**COMMUNITY NAME:** plains rough fescue - western porcupine grass - sedge**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES			SPECIES		
	*	% CANOPY COVER		*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
plains rough fescue (<i>Festuca hallii</i>)	L	20	golden bean (<i>Thermopsis rhombifolia</i>)	E	2
western porcupine grass (<i>Stipa curtiseta</i>)	L	10	low/small-leaved everlasting (<i>Antennaria parvifolia/aprica</i>)	E	2
blunt/dryland sedges (<i>Carex obtusata/stenophylla</i>)	L	10	prairie sage wort (<i>Artemisia ludoviciana</i>)	E	2
salt grass (<i>Distichlis stricta</i>)	E	5	pasture sagewort (<i>Artemisia frigida</i>)	E	2
Nuttall's alkali grass (<i>Puccinellia nuttalliana</i>)	E	5	woolly cinquefoil (<i>Potentilla hippiana</i>)	E	2
alkali bluegrass (<i>Poa juncifolia</i>)	E	5	prairie cinquefoil (<i>Potentilla pensylvanica</i>)	E	2
Rocky Mountain fescue (<i>Festuca saximontana</i>)	E	3	prairie crocus (<i>Anemone patens</i>)	L	2
june grass (<i>Koeleria macrantha</i>)	E	2	creeping/tufted white prairie asters (<i>Aster falcatus/ericoides</i>)	E	1
awned/slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale/trachycaulum</i>)	E	2	mealy primrose (<i>Primula incana</i>)	E	1
northern wheat grass (<i>Agropyron dasystachyum</i>)	E	2	gumweed (<i>Grindelia squarrosa</i>)	E	T
Sandberg bluegrass (<i>Poa sandbergii</i>)	E	1	Missouri goldenrod (<i>Solidago missouriensis</i>)	E	T
western wheat grass (<i>Agropyron smithii</i>)	E	T	saline shooting aster (<i>Dodecatheon pulchellum</i>)	E	T
timber oatgrass (<i>Danthonia intermedia</i>)	E	T	scarlet globe mallow (<i>Sphaeralcea coccinea</i>)	E	T
Canby bluegrass (<i>Poa canbyi</i>)	E	T			
FORBS			SHRUBS		
blue lettuce (<i>Lactuca pulchella</i>)	E	3	buckbrush (<i>Symphoricarpos occidentalis</i>)	E	7
little club-moss (<i>Selaginella densa</i>)	E	3	prairie rose (<i>Rosa arkansana</i>)	E	6

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts**CLIMATE**

- The agroclimate has slight to moderate heat limitations
- Snow cover tends to persist throughout the winter because of cooler temperatures and infrequent influence of chinooks
- July is generally the wettest month
- Growing season P-PE = -150 to -250 mm

SOILS AND LANDSCAPES

- soils are Solonetzic
- landscapes are comprised of level to undulating moraine (till) with veneer and blankets of glaciolacustrine deposits over till

SOIL RECLAMATION ISSUES

- potential for ponding
- potential for soil erosion by wind is low
- potential for water erosion is low
- salt-affected soils require special attention in local areas
- establishment of vegetation may be affected by salts

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- western wheat grass
- northern wheat grass
- slender wheat grass
- awned wheat grass
- plains rough fescue
- Nuttall's alkali grass
- Rocky Mountain fescue
- june grass

- (*Agropyron smithii*)
- (*Agropyron dasystachyum*)
- (*Agropyron trachycaulum* var. *trachycaulum*)
- (*Agropyron trachycaulum* var. *unilaterale*)
- (*Festuca hallii*)
- (*Puccinellia nuttalliana*)
- (*Festuca saximontana*)
- (*Koeleria macrantha*)

PART 2

parkland

NATURAL REGION



PATRICK PORTER



2.1



CENTRAL PARKLAND SUBREGION

*Quit thinking about decent land use as solely an economic problem.
Examine each question in terms of what is ethically and aesthetically right, as
well as what is economically expedient. A thing is right when it tends to
preserve the integrity, stability and beauty of the biotic community.
It is wrong when it tends otherwise.*

Aldo Leopold

2.1.1

SANDY UPLAND SITES**COMMUNITY NAME:** plains rough fescue - sand grass**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
plains rough fescue (<i>Festuca hallii</i>)	L	15	alum-root (<i>Heuchera richardsonii</i>)	E	2
green needle grass (<i>Stipa viridula</i>)	E	10	golden bean (<i>Thermopsis rhombifolia</i>)	E	1
early bluegrass (<i>Poa cusickii</i>)	E	10	skeleton-weed (<i>Lygodesmia juncea</i>)	E	1
sand grass (<i>Calamovilfa longifolia</i>)	L	10	prairie rocket (<i>Erysimum asperum</i>)	E	1
western porcupine grass (<i>Stipa curtisetia</i>)	L	5	narrow-leaved goosefoot (<i>Chenopodium pratericola</i>)	E	1
blunt/dryland sedge (<i>Carex obtusata/stenophylla</i>)	L	5	white evening primrose (<i>Oenothera nuttallii</i>)	E	1
june grass (<i>Koeleria macrantha</i>)	E	3	purple rock cress (<i>Arabis divaricarpa</i>)	E	1
awned wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale</i>)	E	2	bee plant (<i>Cleome serrulata</i>)	E	T
Canada wild rye (<i>Elymus canadensis</i>)	E	1	wild begonia (<i>Rumex venosus</i>)	E	T
plains reed grass (<i>Calamagrostis montanensis</i>)	E	1	milk vetches (<i>Astragalus crassicaupus/dasyglottis/drummondii/flexuosus/striatus</i>)	E	T
northern wheat grass (<i>Agropyron dasystachyum</i>)	E	1	wild licorice (<i>Glycyrrhiza lepidota</i>)	E	T
plains bluegrass (<i>Poa arida</i>)	E	1	purple pea vine (<i>Lathyrus venosus</i>)	E	T
Hooker's oat grass (<i>Helictotrichon hookeri</i>)	E	T	late/early yellow loco-weed (<i>Oxytropis monticola/sericea</i>)	E	T
western wheat grass (<i>Agropyron smithii</i>)	E	T	purple prairie clover (<i>Petalostemon purpureum</i>)	E	T
needle and thread grass (<i>Stipa comata</i>)	E	T	silver-leaf psoralea (<i>Psoralea argophylla</i>)	E	T
sweet grass (<i>Hierochloa odorata</i>)	E	T	hairy golden aster (<i>Heterotheca villosa</i>)	E	T
Indian rice grass (<i>Oryzopsis hymenoides</i>)	E	T	horseweed (<i>Erigeron canadensis</i>)	E	T
sand dropseed (<i>Sporobolus cryptandrus</i>)	E	T	blue lettuce (<i>Lactuca pulchella</i>)	E	T
sheep fescue (<i>Festuca ovina</i>)‡	E	T	prairie sunflower (<i>Helianthus couplandii</i>)	E	T
sand nut-grass (<i>Cyperus schweinitzii</i>)	E	T	prairie sagewort (<i>Artemisia ludoviciana</i>)	E	T
FORBS			SHRUBS		
pasture sagewort (<i>Artemisia frigida</i>)	E	5	creeping juniper (<i>Juniperus horizontalis</i>)	L	10
northern wormwood (<i>Artemisia campestris</i>)	E	3	prickly/prairie rose (<i>Rosa acicularis/arkansana</i>)	E	5
Missouri goldenrod (<i>Solidago missouriensis</i>)	E	2	buckbrush (<i>Symphoricarpos occidentalis</i>)	E	5
prairie/white cinquefoils (<i>Potentilla pensylvanica/arguta</i>)	E	2	wolfwillow (<i>Elaeagnus commutata</i>)	E	4
			ground juniper (<i>Juniperus communis</i>)	L	T

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
 ‡ native origins questionable

CLIMATE

- The agroclimate has slight to moderate heat limitations
- Snow cover tends to persist throughout the winter because of cooler temperatures and infrequent influence of chinooks
- July is generally the wettest month
- Internal drainage of the sandy soils results in these sites being more drought-prone than adjoining sites with heavier soils
- Growing season P-PE = -200 to -300 mm

SOILS AND LANDSCAPES	SOIL RECLAMATION ISSUES
<ul style="list-style-type: none"> • soils are predominantly sandy Chernozems with some Regosols (Dark Brown Chernozems) • undulating Glaciolacustrine and Glaciofluvial deposits are dominant landforms frequently modified by eolian action 	<ul style="list-style-type: none"> • potential risk of soil erosion by wind is high to severe • risk of soil erosion by water generally low although the risk will vary with local conditions • extended dry periods produce seed "burnout" • reseed only when moisture levels are favorable or during dormant period in fall • poor reseeding months (July -August)

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)	
<ul style="list-style-type: none"> • northern or western wheat grass • awned wheat grass • june grass • sand grass • Canada wild rye • green needle grass • plains rough fescue • needle and thread grass • indian rice grass • sheep fescue 	<ul style="list-style-type: none"> (<i>Agropyron dasystachyum</i> or <i>smithii</i>) (<i>Agropyron trachycaulum</i> var. <i>unilaterale</i>) (<i>Koeleria macrantha</i>) (<i>Calamovilfa longifolia</i>) (<i>Elymus canadensis</i>) (<i>Stipa viridula</i>) (<i>Festuca hallii</i>) (<i>Stipa comata</i>) (<i>Oryzopsis hymenoides</i>) (<i>Festuca ovina</i>)

2.1.2

MESIC GRASSLAND**COMMUNITY NAME:** plains rough fescue - western porcupine grass**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
plains rough fescue (<i>Festuca hallii</i>)	L	60	blue lettuce (<i>Lactuca pulchella</i>)	E	2
western porcupine grass (<i>Stipa curtiseta</i>)	L	20	prairie crocus (<i>Anemone patens</i>)	L	2
blunt/sun-loving sedge (<i>Carex obtusata/pensylvanica</i>)	L	10	golden bean (<i>Thermopsis rhombifolia</i>)	E	1
green needle grass (<i>Stipa viridula</i>)	E	10	creeping/tufted white prairie asters (<i>Aster falcatus/ericoides</i>)	E	1
sweet grass (<i>Hierochloa odorata</i>)	E	5	pasture sagewort (<i>Artemisia frigida</i>)	E	1
Rocky mountain fescue (<i>Festuca saximontana</i>)	E	3	milk vetches (<i>Astragalus striatus/dasyglottis/flexuosus/drummondii/crassicaarpus</i>)	E	1
sheep's fescue (<i>Festuca ovina</i>)‡	E	3	bastard toad-flax (<i>Comandra umbellata</i>)	E	1
needle & thread grass (<i>Stipa comata</i>)	E	3	cinquefoils (<i>Potentilla hippiana/pensylvanica/gracilis</i>)	E	1
june grass (<i>Koeleria macrantha</i>)	E	2	purple pea vine (<i>Lathyrus venosus</i>)	L	1
northern wheat grass (<i>Agropyron dasystachyum</i>)	E	2	smooth aster (<i>Aster laevis</i>)	L	T
Hooker's oat grass (<i>Helictotrichon hookeri</i>)	E	2	common yarrow (<i>Achillea millefolium</i>)	E	T
Kentucky bluegrass (<i>Poa pratensis</i>)‡	E	2	blue-eyed grass (<i>Sisyrinchium montanum</i>)	E	T
awned wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale</i>)	L	2	wild blue flax (<i>Linum lewisii</i>)	E	T
western wheat grass (<i>Agropyron smithii</i>)	E	1	smooth fleabane (<i>Erigeron glabellus</i>)	E	T
slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>trachycaulum</i>)	L	1	late/early yellow loco-weeds (<i>Oxytropis monticola/sericea</i>)	E	T
blue grama grass (<i>Bouteloua gracilis</i>)	L	T	American/northern sweet vetches (<i>Hedysarum alpinum/boreale</i>)	E	T
FORBS			purple prairie clover (<i>Petalostemon purpureum</i>)	E	T
prairie sage wort (<i>Artemisia ludoviciana</i>)	L	3	blanket flower (<i>Gaillardia aristata</i>)	E	T
little club-moss (<i>Selaginella densa</i>)	L	3	horse mint (<i>Monarda fistulosa</i>)	E	T
harebell (<i>Campanula rotundifolia</i>)	E	2	SHRUBS		
low/small-leaved everlasting (<i>Antennaria aprica/parvifolia</i>)	E	2	buckbrush (<i>Symphoricarpos occidentalis</i>)	E	7
Canada/long-fruited anemones (<i>Anemone canadensis/cylindrica</i>)	E	2	prairie rose (<i>Rosa arkansana</i>)	E	6
Missouri/stiff goldenrod (<i>Solidago missouriensis/rigida</i>)	E	2	choke cherry (<i>Prunus virginiana</i>)	L	5

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
 ‡ native origins questionable

CLIMATE

- The agroclimate has slight to moderate heat limitations
- Snow cover tends to persist throughout the winter because of cooler temperatures and infrequent influence of chinooks
- July is generally the wettest month
- Growing season P-PE = -150 to -250 mm

SOILS AND LANDSCAPES

- soils are predominantly Black Chernozems with a few Solonetzic types
- Chernozemic soils have between 15 and 30 cm of a black colored A horizon which is developed to 65 cm
- the Solonetzic soils are shallower and have less top soil
- undulating moraine (till) landscapes are the most common with some hummocky areas, and Glaciolacustrine and Glaciofluvial deposits comprise other significant land forms

SOIL RECLAMATION ISSUES

- potential soil erosion by water is generally low although the risk varies with local conditions
- the risk of soil erosion by wind is low to moderate except for sandy-textured areas where it is high
- Solonetzic soils, shallow soils with saline and sodic soft rock, and others with highly saline and sodic subsoils may require special soil handling during stripping and trenching

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slender wheat grass
- awned wheat grass
- northern wheat grass
- green needle grass
- western wheat grass
- Rocky mountain fescue
- june grass
- plains rough fescue
- sheep fescue
- blue grama grass
- wild blue flax
- needle & thread grass

(Agropyron trachycaulum var. trachycaulum)
(Agropyron trachycaulum var. unilaterale)
(Agropyron dasystachyum)
(Stipa viridula)
(Agropyron smithii)
(Festuca saximontana)
(Koeleria macrantha)
(Festuca hallii)
(Festuca ovina)
(Bouteloua gracilis)
(Linum lewisii)
(Stipa comata)

2.1.3

DECIDUOUS**COMMUNITY NAME:** aspen - buckbrush**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
plains rough fescue (<i>Festuca hallii</i>)	L	15	northern bedstraw (<i>Galium boreale</i>)	E	T
fringed brome (<i>Bromus ciliatus</i>)	L	8	horse mint (<i>Monarda fistulosa</i>)	E	T
awned/slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale</i> /trachycaulum)	L	8	American/northern sweet vetches (<i>Hedysarum alpinum</i> /boreale)	E	T
Kentucky blue grass (<i>Poa pratensis</i>)‡	E	3	wild licorice (<i>Glycyrrhiza lepidota</i>)	E	T
bluejoint (<i>Calamagrostis canadensis</i>)	L	3	narrow-leaved hawkweed (<i>Hieracium umbellatum</i>)	E	T
woodland blue grass (<i>Poa interior</i>)	E	2	purple pea vine (<i>Lathyrus venosus</i>)	E	T
FORBS			SHRUBS		
American vetch (<i>Vicia americana</i>)	E	3	buckbrush (<i>Symphoricarpos occidentalis</i>)	E	10
cream-coloured pea vine (<i>Lathyrus ochroleucus</i>)	E	2	roses (<i>Rosa acicularis</i> /woodsi/arkansana)	E	5
Lindley's aster (<i>Aster ciliolatus</i>)	E	2	raspberry (<i>Rubus idaeus</i>)	E	5
common pink/white wintergreens (<i>Pyrola asarifolia</i> /elliptica)	E	2	beaked hazelnut (<i>Corylus cornuta</i>)	E	4
Canada goldenrod (<i>Solidago canadensis</i>)	E	2	saskatoon (<i>Amelanchier alnifolia</i>)	E	2
smooth aster (<i>Aster laevis</i>)	L	1	choke cherry (<i>Prunus virginiana</i>)	E	2
early blue/western Canada violets (<i>Viola adunca</i> /canadensis)	E	1	pin cherry (<i>Prunus pensylvanica</i>)	E	2
western meadow rue (<i>Thalictrum venulosum</i>)	E	1	meadow willow (<i>Salix petiolaris</i>)	E	1
common yarrow (<i>Achillea millefolium</i>)	E	T	TREES		
fireweed (<i>Epilobium angustifolium</i>)	E	T	trembling aspen (<i>Populus tremuloides</i>)	L	55

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
‡ native origins questionable

CLIMATE

- The agroclimate has slight to moderate heat limitations
- Snow cover tends to persist throughout the winter because of cooler temperatures and the infrequent influence of chinooks
- July is generally the wettest month
- Growing season P-PE = -150 to -250 mm

SOILS AND LANDSCAPES

- soils are predominantly Dark Gray Luvisols
- undulating moraine (till) landscape is the most common, with Glaciolacustrine and Glaciofluvial deposits comprising the significant landforms
- some hummocky landscapes exist

SOIL RECLAMATION ISSUES

- potential soil erosion by water is generally low although the risk varies with local conditions
- the risk of soil erosion by wind is low to moderate except for sandy-textured areas where it is high

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slender wheat grass
- plains rough fescue
- awned wheat grass

(*Agropyron trachycaulum* var. *trachycaulum*)

(*Festuca hallii*)

(*Agropyron trachycaulum* var. *unilaterale*)

2.1.4

SUBHYGRIC GRASSLANDS**COMMUNITY NAME:** sedge meadows (fresh and saline sites)**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			GRASSES/GRASS-LIKE <i>continued</i>		
FRESH WATER SITES			Baltic rush (<i>Juncus balticus</i>)	E	5
water sedge (<i>Carex aquatilis</i>)	L	50	alkali cord grass (<i>Spartina gracilis</i>)	L	2
awned sedge (<i>Carex atherodes</i>)	L	10			
Baltic rush (<i>Juncus balticus</i>)	E	5	FORBS		
beaked sedge (<i>Carex rostrata</i>)	L	5	golden/narrow-leaved dock (<i>Rumex maritimus/triangulivalis</i>)	E	5
slough grass (<i>Beckmannia syzigachne</i>)	L	5	water hemlock (<i>Cicuta maculata</i>)	E	4
water foxtail (<i>Alopecurus aequalis</i>)	L	3	water parsnip (<i>Sium suave</i>)	E	3
northern reed grass (<i>Calamagrostis inexpansa</i>)	L	2	seaside/slender arrow-grass (<i>Triglochin maritima/palustris</i>)	E	2
narrow-leaved reed grass (<i>Calamagrostis stricta</i>)	L	2	wild mint (<i>Mentha arvensis</i>)	E	2
woolly sedge (<i>Carex lanuginosa</i>)	L	2	mealy primrose (<i>Primula incana</i>)	E	1
tall manna grass (<i>Glyceria grandis</i>)	L	2	western willow aster (<i>Aster hesperius</i>)	E	1
graceful sedge (<i>Carex praegracilis</i>)	E	2	buttercups (<i>Ranunculus sceleratus/cymbalaria/macounii</i>)	E	1
spangle top (<i>Scolochloa festucea</i>)	E	1	silverweed (<i>Potentilla anserina</i>)	E	1
creeping spike rush (<i>Eleocharis palustris</i>)	E	1	saline shooting star (<i>Dodecatheon pulchellum</i>)	E	1
bluegrasses (<i>Poa palustris/juncifolia/canbyi</i>)	E	T	northern willow herb (<i>Epilobium ciliatum</i>)	E	T
slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>trachycaulum</i>)	E	T	rush aster (<i>Aster borealis</i>)	E	T
SALINE SITES			hedge nettle (<i>Stachys palustris</i>)	E	T
Nuttall's alkali grass (<i>Puccinellia nuttalliana</i>)	L	15			
foxtail barley (<i>Hordeum jubatum</i>)	E	10	SHRUBS		
bulrush (<i>Scirpus acutus/validus/pungens/paludosus</i>)	L	10	willows (<i>Salix bebbiana/petiolaris/dicolor</i>)	E	25
salt grass (<i>Distichlis stricta</i>)	L	5	wild gooseberry (<i>Ribes oxycanthoides</i>)	E	3

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts

CLIMATE

- The agroclimate has slight to moderate heat limitations
- Snow cover tends to persist throughout the winter because of cooler temperatures and infrequent influence of chinooks
- July is generally the wettest month
- Growing season P-PE = -150 to -250 mm

SOILS AND LANDSCAPES

- soils are predominantly Gleysols
- low areas in the undulating and hummocky moraine landscapes or glaciolacustrine deposits

SOIL RECLAMATION ISSUES

- potential for soil erosion by water can be high
- highly saline and sodic subsoils may require special soil handling during stripping and trenching
- risk of soil erosion is low except during construction phases; also higher risk in sandy textures

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slough grass
- slender wheat grass
- Nuttall's alkali grass
- fowl bluegrass

(*Beckmannia syzigachne*)
 (*Agropyron trachycaulum* var. *trachycaulum*)
 (*Puccinellia nuttalliana*)
 (*Poa palustris*)

2.1.5

SOLONETZIC SITES

COMMUNITY NAME: plains rough fescue - western porcupine
grass - sedge

CLIMAX COMMUNITY DESCRIPTION (ungrazed):

**VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
plains rough fescue (<i>Festuca hallii</i>)	L	20	golden bean (<i>Thermopsis rhombifolia</i>)	E	2
western porcupine grass (<i>Stipa curtisetia</i>)	L	10	low/small-leaved everlasting (<i>Antennaria parvifolia/aprica</i>)	E	2
blunt/dryland sedges (<i>Carex obtusata/stenophylla</i>)	L	10	prairie sagewort (<i>Artemisia ludoviciana</i>)	E	2
alkali bluegrass (<i>Poa juncifolia</i>)	E	5	pasture sagewort (<i>Artemisia frigida</i>)	E	2
salt grass (<i>Distichlis stricta</i>)	E	5	woolly cinquefoil (<i>Potentilla hippiana</i>)	E	2
Nuttall's alkali grass (<i>Puccinellia nuttalliana</i>)	E	5	prairie cinquefoil (<i>Potentilla pensylvanica</i>)	E	2
Rocky Mountain fescue (<i>Festuca saximontana</i>)	E	3	prairie crocus (<i>Anemone patens</i>)	L	2
june grass (<i>Koeleria macrantha</i>)	E	2	creeping/tufted white prairie asters (<i>Aster falcatus/ericoides</i>)	E	1
awned/slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale/trachycaulum</i>)	E	2	mealy primrose (<i>Primula incana</i>)	E	1
northern wheat grass (<i>Agropyron dasystachyum</i>)	E	2	gumweed (<i>Grindelia squarrosa</i>)	E	T
Sandberg bluegrass (<i>Poa sandbergii</i>)	E	1	Missouri goldenrod (<i>Solidago missouriensis</i>)	E	T
western wheat grass (<i>Agropyron smithii</i>)	E	T	saline shooting aster (<i>Dodecatheon pulchellum</i>)	E	T
timber oatgrass (<i>Danthonia intermedia</i>)	E	T	scarlet globe mallow (<i>Sphaeralcea coccinea</i>)	E	T
canby bluegrass (<i>Poa canbyi</i>)	E	T			
FORBS			SHRUBS		
blue lettuce (<i>Lactuca pulchella</i>)	E	3	buckbrush (<i>Symphoricarpos occidentalis</i>)	E	7
little club-moss (<i>Selaginella densa</i>)	L	3	prairie rose (<i>Rosa arkansana</i>)	E	6

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts

CLIMATE

- The agroclimate has slight to moderate heat limitations
- Snow cover tends to persist throughout the winter because of cooler temperatures and infrequent influence of chinooks
- July is generally the wettest month
- Growing season P-PE = -150 to -250 mm

SOILS AND LANDSCAPES

- Solonetzic soils
- landscapes are level to undulating moraine (till) with veneer and blankets of glaciolacustrine deposits over till
- potential to pond water

SOIL RECLAMATION ISSUES

- low potential for wind erosion
- low potential for water erosion
- salt-affected soils require special attention in local areas
- vegetation establishment may be affected by salts

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- western wheat grass
- northern wheat grass
- slender wheat grass
- awned wheat grass
- plains rough fescue
- Nuttall's alkali grass
- Rocky Mountain fescue
- june grass

(Agropyron smithii)
(Agropyron dasystachyum)
(Agropyron trachycaulum var. trachycaulum)
(Agropyron trachycaulum var. unilaterale)
(Festuca hallii)
(Puccinellia nuttalliana)
(Festuca saximontana)
(Koeleria macrantha)

2.2



FOOTHILLS PARKLAND SUBREGION

*Niche can be thought of as the abstract address
at the intersection of a hundred biophysical streets.*

Don Gayton, *The Wheatgrass Mechanism*. (1990)

2.2.1

MESIC GRASSLAND**COMMUNITY NAME:** rough fescue - Parry oat grass/shrubby cinquefoil**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
rough fescue (<i>Festuca campestris</i>)	L	30	veiny meadow rue (<i>Thalictrum venulosum</i>)	E	4
Parry oat grass (<i>Danthonia parryi</i>)	E	25	yellow/slender-blue beard-tongues (<i>Penstemon confertus/procerus</i>)	E	3
fringed brome (<i>Bromus ciliatus</i>)	E	15	northern bedstraw (<i>Galium boreale</i>)	E	1
sedges (<i>Carex raymondii/astrosquamal/macloviana/microptera</i>)	L	15	smooth fleabane (<i>Erigeron glabellus</i>)	E	1
mountain brome (<i>Bromus carinatus</i>)	E	10	smooth aster (<i>Aster laevis</i>)	E	1
Idaho fescue (<i>Festuca idahoensis</i>)	E	7	graceful cinquefoil (<i>Potentilla gracilis</i>)	E	1
nodding brome (<i>Bromus anomalus</i>)	E	5	Canada goldenrod (<i>Solidago canadensis</i>)	E	T
alpine timothy (<i>Phleum commutatum</i>)	E	5	silky lupine (<i>Lupinus sericeus</i>)	E	T
California oat grass (<i>Danthonia californica</i>)	L	2	blue-eyed grass (<i>Sisyrinchium montanum</i>)	E	T
awned/slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale/trachycaulum</i>)	E	2	purple/ascending purple milk vetch (<i>Astragalus dasyglottis/striatus</i>)	E	T
rocky mountain fescue (<i>Festuca saximontana</i>)	E	1	American sweet vetch (<i>Hedysarum alpinum</i>)	E	T
Kentucky bluegrass (<i>Poa pratensis</i>)†	E	1	late yellow/reflexed loco-weeds (<i>Oxytropis monticola/deflexa</i>)	E	T
northern awnless brome (<i>Bromus pumpellianus</i>)	E	1	common yarrow (<i>Achillea millefolium</i>)	E	T
sweet grass (<i>Hierochloa odorata</i>)	L	1	northern gentian (<i>Gentianella amarella</i>)	E	T
FORBS			leafy arnica (<i>Arnica chamissonis</i>)	E	T
mountain shooting star (<i>Dodecatheon conjugens</i>)	L	12	SHRUBS		
old man's whiskers (<i>Geum triflorum</i>)	E	10	shrubby cinquefoil (<i>Potentilla fruticosa</i>)	E	10
			smooth/beaked willows (<i>Salix glauca/bebbiana</i>)	E	2

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
 ‡ native origins questionable

CLIMATE

- Agroclimate has severe heat limitations
- Although temperatures are cooler and more precipitation is received during the growing season, moisture deficits do occur
- Accumulation of snow is higher but chinook activity results in a considerable draw down
- Growing season P-PE = -150 to -200 mm

SOILS AND LANDSCAPES	SOIL RECLAMATION ISSUES
<ul style="list-style-type: none"> • soils are predominantly Orthic Black Chernozems • landforms are highly influenced by the underlying bedrock; veneers and blankets of glacial drift overlie Tertiary and Cretaceous-aged bedrock of varying lithology • landscapes are undulating to hummocky and rolling • soil profile development is generally 50 cm deep with 20 to 30 cm of black-colored A horizon 	<ul style="list-style-type: none"> • frequent strong winds cause erosion when the soil is disturbed • potential soil erosion by water generally ranges from severe to moderate, although local conditions vary widely

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)	
<ul style="list-style-type: none"> • rough fescue • slender wheat grass • awned wheat grass • northern awnless brome • American sweet vetch • Rocky Mountain fescue • Idaho fescue 	<ul style="list-style-type: none"> (<i>Festuca campestris</i>) (<i>Agropyron trachycaulum</i> var. <i>trachycaulum</i>) (<i>Agropyron trachycaulum</i> var. <i>unilaterale</i>) (<i>Bromus pumpellianus</i>) (<i>Hedysarum alpinum</i>) (<i>Festuca saximontana</i>) (<i>Festuca idahoensis</i>)

2.2.2

SUBHYGRIC SHRUBLANDS (DRAINAGES)**COMMUNITY NAME:** Scouler's willow-Bebb's willow**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
hairy wildrye (<i>Elymus innovatus</i>)	L	13	mountain shooting star (<i>Dodecatheon conjugens</i>)	E	4
bluejoint (<i>Calamagrostis canadensis</i>)	L	10	bunchberry (<i>Cornus canadensis</i>)	E	3
fringed brome (<i>Bromus ciliatus</i>)	E	2	smooth aster (<i>Aster laevis</i>)	E	2
sedges (<i>Carex raymondii/astrosquamal/macloviana/microptera</i>)	L	2	smooth fleabane (<i>Erigeron glabellus</i>)	E	1
awned/slender wheat grass (<i>Agropyron/trachycaulum</i> var. <i>unilaterale/trachycaulum</i>)	E	1	graceful cinquefoil (<i>Potentilla gracilis</i>)	E	1
Kentucky bluegrass (<i>Poa pratensis</i>)‡	E	1	Canada goldenrod (<i>Solidago canadensis</i>)	E	1
northern awnless brome (<i>Bromus pumpellianus</i>)	E	1	Amercian sweet vetch (<i>Hedysarum alpinum</i>)	E	1
sweet grass (<i>Hierochloa odorata</i>)	L	1	common yarrow (<i>Achillea millefolium</i>)	E	T
mountain brome (<i>Bromus carinatus</i>)	E	T	northern gentian (<i>Gentianella amarella</i>)	E	T
			leafy arnica (<i>Arnica chamissonis</i>)	E	T
FORBS			SHRUBS		
northern bedstraw (<i>Galium boreale</i>)	L	13	smooth/beaked willows (<i>Salix glauca/bebbiana</i>)	E	25
veiny meadow rue (<i>Thalictrum venulosum</i>)	E	10	scouler's willow (<i>Salix scouleriana</i>)	L	20
western Canada violet (<i>Viola canadensis</i>)	E	8	shrubby cinquefoil (<i>Potentilla fruticosa</i>)	L	8
red baneberry (<i>Actaea rubra</i>)	E	5			

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
‡ native origins questionable

CLIMATE

- Agroclimate has severe heat limitations
- Although temperatures are cooler and more precipitation is received during the growing season, moisture deficits do occur
- Accumulation of snow is higher but chinook activity results in a considerable draw down
- Growing season P-PE = -150 to -200 mm

SOILS AND LANDSCAPES

- soils are predominantly Orthic Black Chernozems
- landforms are highly influenced by the underlying bedrock; veneers and blankets of glacial drift overlie Tertiary and Cretaceous-aged bedrock of varying lithology
- landscapes are undulating to hummocky and rolling
- soil profile development is generally 50 cm deep with 20 to 30 cm of black-colored A horizon

SOIL RECLAMATION ISSUES

- frequent strong winds cause erosion when the soil is disturbed
- potential soil erosion by water generally ranges from severe to moderate, although local conditions vary widely

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slender wheat grass
- awned wheat grass

(*Agropyron trachycaulum* var. *trachycaulum*)
 (*Agropyron trachycaulum* var. *unilaterale*)

2.3



PEACE RIVER PARKLAND

*In one human lifetime, the prairies have passed
from wilderness to become the most altered habitat
in this country and one of the most disturbed,
ecologically simplified and
overexploited regions in the world.*

Adrian Forsyth, *The End of Emptiness*. Equinox 11; 66-78 (1983).

2.3.1

PEACE RIVER SLOPES**COMMUNITY NAME:** western porcupine grass - june grass - sedge**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
western porcupine grass (<i>Stipa curtisetia</i>)	L	46	cinquefoils (<i>Potentilla gracilis/hippiana/pensylvanica</i>)	E	1
june grass (<i>Koeleria macrantha</i>)	L	13	milk vetches (<i>Astragalus striatus/dasyglottis/tennelus/aboriginum/bisulcatus</i>)	E	1
blunt sedge (<i>Carex obtusata</i>)	L	13	small-leaved/rosy everlasting (<i>Antennaria parviflora/rosea</i>)	E	1
Columbia needle grass (<i>Stipa columbiana</i>)	E	5	northern wormwood (<i>Artemisia campestris</i>)	E	1
Rocky Mountain fescue (<i>Festuca saximontana</i>)	E	2	creeping white/smooth aster (<i>Aster falcatus/laevis</i>)	L	1
northern wheat grass (<i>Agropyron dasytachyum</i>)	L	2	tufted/smooth fleabanes (<i>Erigeron caespitosus/glabellus</i>)	E	1
awned/slender wheat grass (<i>Agropyrontrachycaulum</i> var. <i>unilaterale/trachycaulum</i>)	E	1	Missouri/mountain goldenrods (<i>Solidago missouriensis/spathulata</i>)	E	1
western wheat grass (<i>Agropyron smithii</i>)	E	1	wild blue flax (<i>Linum lewisii</i>)	E	T
green needle grass (<i>Stipa viridula</i>)	E	1	harebell (<i>Campanula rotundifolia</i>)	E	T
plains reed grass (<i>Calamagrostis montanensis</i>)	E	T	scarlet globe mallow (<i>Sphaeralcea coccinea</i>)	E	T
FORBS			SHRUBS		
common yarrow (<i>Achillea millefolium</i>)	E	1	snowberry/buckbrush (<i>Symphoricarpos albus/occidentalis</i>)	E	4
pasture/prairie sagewort (<i>Artemisia frigida/ludoviciana</i>)	E	1	saskatoon (<i>Amelanchier alnifolia</i>)	E	2
nodding onion (<i>Allium cernuum</i>)	E	1	choke cherry (<i>Prunus virginiana</i>)	E	1
bastard toad-flax (<i>Comandra umbellata</i>)	E	1	pin cherry (<i>Prunus pensylvanica</i>)	E	1
mouse-earns chickweed (<i>Cerastium arvense</i>)	E	1	prairie rose (<i>Rosa arkansana</i>)	E	1
cut-leaved anemone (<i>Anemone multifida</i>)	E	1			

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts

CLIMATE

- The agroclimate has slight to moderate heat limitations
- Precipitation is similar to the Dry Mixedwood and Central Parkland Subregions
- Summer temperatures are warmer than the other Boreal Subregions
- Growing season P-PE = -200 to -250 mm

SOILS AND LANDSCAPES

- soils are mainly Dark Gray Luvisols and some Solonetzic Luvisols with significant Black Chernozems and small areas of Regosols on upper slopes
- landscapes are predominantly glaciolacustrine and moraines with long or steeper slopes along the Peace River

SOIL RECLAMATION ISSUES

- the risk of soil erosion by water is very high to severe along the Peace River
- the risk of soil erosion by wind is generally low

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100)

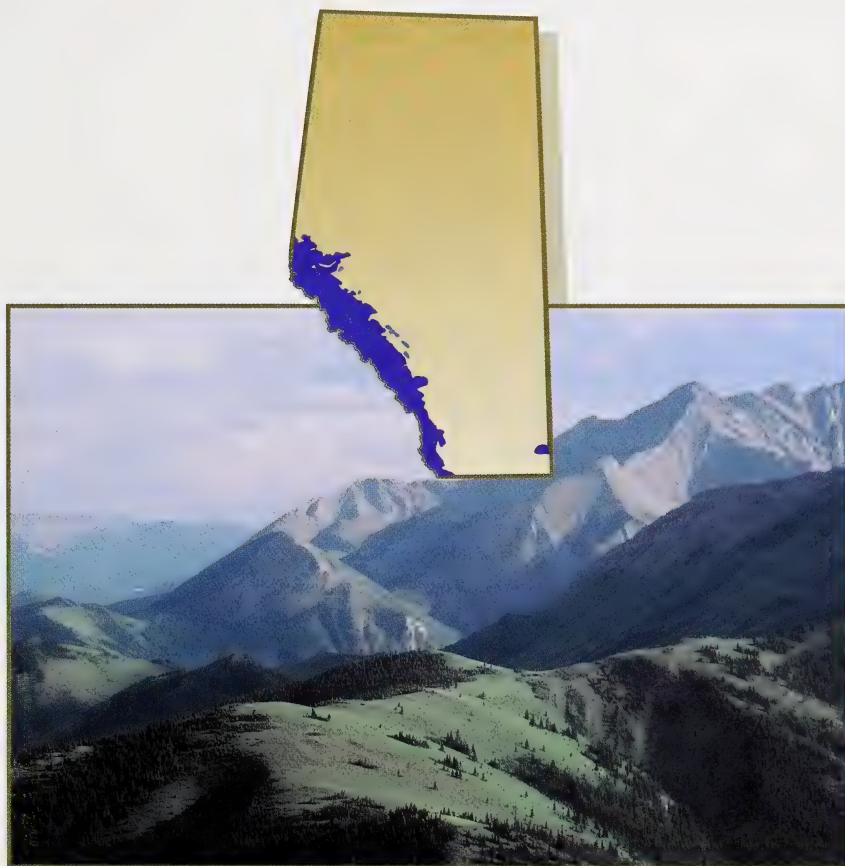
- green needle grass
- northern wheat grass
- slender wheat grass
- awned wheat grass
- june grass
- western wheat grass
- Rocky Mountain fescue
- wild blue flax

(Stipa viridula)
(Agropyron dasystachyum)
(Agropyron trachycaulum var. trachycaulum)
(Agropyron trachycaulum var. unilaterale)
(Koeleria macrantha)
(Agropyron smithii)
(Festuca saximontana)
(Linum lewisii)

PART 3

rocky mountain

NATURAL REGION



GERALD HAEKEL



3.1



MONTANE SUBREGION

*Environmental citizenship is about contributing—
about doing your part.*

It means becoming informed and getting involved.

It means believing you can make a difference.

It means caring for Canada.

Environment Canada, *The Nature of Canada: A Primer on Spaces and Species* (1993).

3.1.1

SUBXERIC GRASSLAND
(STEEP, ROCKY, SOUTH FACING SLOPES)

COMMUNITY NAME: bluebunch wheat grass - dryland sedges

CLIMAX COMMUNITY DESCRIPTION (ungrazed):

**VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
bluebunch wheat grass (<i>Agropyron spicatum</i>)	L	22	northern wormwood (<i>Artemisia campestris</i>)	E	2
blunt/dryland sedge (<i>Carex obtusata/stenophylla</i>)	L	10	compound/tufted fleabane (<i>Erigeron compositus/caespitosus</i>)	E	2
rough fescue (<i>Festuca campestris</i>)	L	5	nodding onion (<i>Allium cernuum</i>)	E	1
early bluegrass (<i>Poa cusickii</i>)	E	2	Indian milk vetch (<i>Astragalus aboriginum</i>)	E	1
june grass (<i>Koeleria macrantha</i>)	L	2	yellow umbrella-plant (<i>Eriogonum flavum</i>)	E	1
northern wheat grass (<i>Agropyron dasystachyum</i>)	E	1	double bladder-pod (<i>Physaria didymocarpa</i>)	E	1
sheep fescue (<i>Festuca saximontana</i>)	E	1	prairie groundsel (<i>Senecio canus</i>)	E	1
Idaho fescue (<i>Festuca idahoensis</i>)	L	1	leafy musineon (<i>Musineon divaricatum</i>)	L	1
FORBS			white/purple prairie clover (<i>Petalostemon candidum/purpureum</i>)	E	T
long fruited parsley (<i>Lomatium macrocarpum</i>)	E	5	SHRUBS		
smooth blue beard-tongue (<i>Penstemon nitidus</i>)	E	5	snowberry (<i>Symphoricarpos occidentalis</i>)	E	9
early/late yellow loco-weeds (<i>Oxytropis sericea/monticola</i>)	E	5	prickly rose (<i>Rosa acicularis</i>)	E	8
pasture sagewort (<i>Artemisia frigida</i>)	E	4	saskatoon (<i>Amelanchier alnifolia</i>)	E	7
northern sweet vetch (<i>Hedysarum boreale</i>)	E	2	creeping juniper (<i>Juniperus horizontalis</i>)	L	2

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts**CLIMATE**

- The agroclimate varies from slight, in the south to severe heat limitations farther north or at higher elevations
- Temperatures cooler and more precipitation is received during the growing season
- Topography and exposure increase surface drying, resulting in frequent moisture deficits
- Little accumulation of snow occurs due to aspect and exposure to winds
- Growing season P-PE = 250 to 350 mm

SOILS AND LANDSCAPES	SOIL RECLAMATION ISSUES
<ul style="list-style-type: none"> • soils are Orthic Regosols, Eutric Brunisols • landforms are highly influenced by underlying bedrock • soil profiles are shallow and sometimes poorly defined • landscapes are rolling to ridged 	<ul style="list-style-type: none"> • potential soil erosion by water is generally high • wind erosion is a major concern due to the exposure to high velocity winds • snow cover generally does not exist, thus exposing the surface to erosion year-round

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY(>100kg)	
<ul style="list-style-type: none"> • bluebunch wheat grass • june grass • Rocky Mountain fescue • northern wheat grass • rough fescue • Idaho fescue 	<ul style="list-style-type: none"> (<i>Agropyron spicatum</i>) (<i>Koeleria macrantha</i>) (<i>Festuca saximontana</i>) (<i>Agropyron dasystachyum</i>) (<i>Festuca campestris</i>) (<i>Festuca idahoensis</i>)

3.1.2

GRASSLANDS (MESIC, MID TO LOWER SLOPE POSITIONS)

COMMUNITY NAME: rough fescue-idaho fescue-Parry oatgrass

CLIMAX COMMUNITY DESCRIPTION (ungrazed):

**VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
rough fescue (<i>Festuca campestris</i>)	L	37	mountain shooting star (<i>Dodecatheon conjugens</i>)	L	7
awned/slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale</i> / <i>trachycaulum</i>)	E	15	old man's whiskers (<i>Geum triflorum</i>)	E	4
Idaho fescue (<i>Festuca idahoensis</i>)	E	10	common yarrow (<i>Achillea millefolium</i>)	E	3
green needle grass (<i>Stipa viridula</i>)	E	10	northern bedstraw (<i>Galium boreale</i>)	E	3
northern awnless brome (<i>Bromus pumpellianus</i>)	E	10	showy fleabane (<i>Erigeron speciosus</i>)	E	2
mountain brome (<i>Bromus carinatus</i>)	E	10	false dandelion (<i>Agoseris glauca</i>)	E	2
western/northern wheat grass (<i>Agropyron smithii</i> / <i>dasystachyum</i>)	E	5	balsam-root (<i>Balsamorhiza sagittata</i>)	E	1
California oat grass (<i>Danthonia californica</i>)	L	3	wild blue flax (<i>Linum lewisii</i>)	E	T
june grass (<i>Koeleria macrantha</i>)	E	2	loco-weeds (<i>Oxytropis monticola</i> / <i>sericea</i> / <i>splendens</i> / <i>viscida</i>)	E	T
Kentucky bluegrass (<i>Poa pratensis</i>)‡	E	2	graceful cinquefoil (<i>Potentilla gracilis</i>)	E	T
Richardson needle grass (<i>Stipa richardsonii</i>)	E	1	American sweet vetch (<i>Hedysarum alpinum</i>)	E	T
Columbia needle grass (<i>Stipa columbiana</i>)	E	1	harebell (<i>Campanula rotundifolia</i>)	E	T
sun-loving/Hood's sedge (<i>Carex pensylvanica</i> / <i>hoodii</i>)	L	1	smooth aster (<i>Aster laevis</i>)	E	T
plains reed grass (<i>Calamagrostis montanensis</i>)	E	T	yellow/slender bluebeard-tongue (<i>Penstemon confertus</i> / <i>procerus</i>)	E	T
FORBS			horse mint (<i>Monarda fistulosa</i>)	E	T
silky/silvery lupine (<i>Lupinus sericeus</i> / <i>argenteus</i>)	E	11	anemones (<i>Anemone patens</i> / <i>cylindrica</i> / <i>multifida</i>)	E	T
sticky purple geranium (<i>Geranium viscosissimum</i>)	L	8	northern gentian (<i>Gentianella amarella</i>)	E	T
			blanket flower (<i>Gaillardia aristata</i>)	E	T
			silky scorpion weed (<i>Phacelia sericea</i>)	E	T
			SHRUBS		
			shrubby cinquefoil (<i>Potentilla fruticosa</i>)	E	3

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
 ‡ native origins questionable

CLIMATE

- The agroclimate has severe heat limitations
- Temperatures are cool and more precipitation is received during the growing season, but moisture deficits do occur
- Accumulation of snow is higher but chinook activities result in a lower snow cover
- Equal to rangeland to the east
- Growing season P-PE = -150 to -250 mm

SOILS AND LANDSCAPES

- soils are predominantly Black Chernozems
- landforms are highly influenced by the underlying bedrock
- veneers and blankets of glacial drift overlie Tertiary and Cretaceous-aged bedrock of varying lithology
- landscapes are undulating to hummocky to rolling
- soil profile development is generally 50 cm deep with 20 to 30 cm of black colored A horizon

SOIL RECLAMATION ISSUES

- frequent strong winds cause erosion when the soil is disturbed
- potential soil erosion by water generally ranges from severe to moderate, although local conditions vary widely

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slender wheat grass
- green needle grass
- rough fescue
- june grass
- Idaho fescue
- northern wheat grass
- western wheat grass
- awned wheat grass
- wild blue flax

(*Agropyron trachycaulum* var. *trachycaulum*)
 (*Stipa viridula*)
 (*Festuca campestris*)
 (*Koeleria macrantha*)
 (*Festuca idahoensis*)
 (*Agropyron dasystachyum*)
 (*Agropyron smithii*)
 (*Agropyron trachycaulum* var. *unilaterale*)
 (*Linum lewisii*)

3.1.3

DECIDUOUS**COMMUNITY NAME:** aspen poplar**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
pine grass (<i>Calamagrostis rubescens</i>)	L	20	Lindley's aster (<i>Aster ciliolatus</i>)	E	1
bluejoint (<i>Calamagrostis canadensis</i>)	L	10	sweet cicely (<i>Osmorhiza depauperata</i>)	E	1
fringed brome (<i>Bromus ciliatus</i>)	E	10	Indian paint-brushes (<i>Castilleja miniata/occidentalis</i>)	L	1
mountain brome (<i>Bromus carinatus</i>)	E	5	tall lungwort (<i>Mertensia paniculata</i>)	L	1
smooth wild rye (<i>Elymus glaucus</i>)	E	3	alpine goldenrod (<i>Solidago multiradiata</i>)	E	T
hairy wild rye (<i>Elymus innovatus</i>)	L	3	alpine aster (<i>Aster alpinus</i>)	E	T
awned/slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale/trachycaulum</i>)	E	2	Amercian milk vetch (<i>Astragalus americanus</i>)	E	T
spike trisetum (<i>Trisetum spicatum</i>)	E	1	American/yellow sweet vetch (<i>Hedysarum alpinum/sulphurens</i>)	E	T
purple oat grass (<i>Schizachne purpurascens</i>)	E	1	cut-leaved anemone (<i>Anemone multifida</i>)	E	T
white-grained mountain rice grass (<i>Oryzopsis asperifolia</i>)	E	1	smooth/showy fleabanes (<i>Erigeron glabellus/speciosus</i>)	E	T
purple reed grass (<i>Calamagrostis purpurascens</i>)	E	T	white camus (<i>Zigadenus elegans</i>)	E	T
FORBS			SHRUBS		
showy aster (<i>Aster conspicuus</i>)	E	6	wild rose (<i>Rosa woodsii</i>)	E	17
wild strawberry (<i>Fragaria virginiana</i>)	E	5	white meadow sweet (<i>Spiraea betulifolia</i>)	E	7
fireweed (<i>Epilobium angustifolium</i>)	E	4	saskatoon (<i>Amelanchier alnifolia</i>)	E	5
cream coloured pea vine (<i>Lathyrus ochroleucus</i>)	E	4	buckbrush (<i>Symphoricarpos occidentalis</i>)	E	2
veiny meadow rue (<i>Thalictrum venulosum</i>)	E	2	TREES		
American vetch (<i>Vicia americana</i>)	E	2	trembling aspen (<i>Populus tremuloides</i>)	L	65
cow parsnip (<i>Heracleum lanatum</i>)	E	2			

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts

CLIMATE

- The agroclimate varies from slight to severe heat limitations
- Temperatures are cooler and more precipitation is received during the growing season but moisture deficits may occur (micro climate due to aspect and topography favour these sites)
- Accumulation of snow occurs but chinook activity may result in periods of moisture deficit

SOILS AND LANDSCAPES

- soils are Brunisols, Luvisols and Dark Gray Chernozems
- frequently shallow veneers overlying bedrock
- landscapes can be undulating to rolling or even ridged
- landforms are highly influenced by the underlying bedrock

SOIL RECLAMATION ISSUES

- potential soil erosion by water generally ranges from severe to moderate, although local conditions vary widely
- wind erosion potential is generally moderate though slopes exposed to chinooks may be vulnerable

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slender wheat grass
- awned wheat grass
- American vetch

(Agropyron trachycaulum var. trachycaulum)
(Agropyron trachycaulum var. unilaterale)
(Vicia americana)

3.1.4

CONIFER**COMMUNITY NAME:** Douglas fir - lodgepole pine**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
sedges (<i>Carex rossii/platylepis</i>)	L	6	fireweed (<i>Epilobium angustifolium</i>)	E	T
pine grass (<i>Calamagrostis rubescens</i>)†	L	5	American milk vetch (<i>Astragalus americanus</i>)	E	T
hairy wild rye (<i>Elymus innovatus</i>)	L	3	white camus (<i>Zigadenus elegans</i>)	E	T
fringed brome (<i>Bromus ciliatus</i>)	E	T	wild blue flax (<i>Linum lewisii</i>)	E	T
awned/slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale/trachycaulum</i>)	E	T	showy aster (<i>Aster conspicuus</i>)	E	T
mountain brome (<i>Bromus carinatus</i>)	E	T			
FORBS			SHRUBS		
twin-flower (<i>Linnaea borealis</i>)	E	15	tall bilberry (<i>Vaccinium membranaceum</i>)	E	26
showy aster (<i>Aster conspicuus</i>)	E	5	bearberry (<i>Arctostaphylos uva-ursi</i>)	E	10
mountain/heart-leaved arnica (<i>Arnica latifolia/cordifolia</i>)	E	4	Canadian buffalo-berry (<i>Shepherdia canadensis</i>)	E	4
Indian paint-brushes (<i>Castilleja rhexifolia/miniata/occidentalis</i>)	L	2	low/dwarf bilberry (<i>Vaccinium myrtillus/caespitosum</i>)	E	2
American/yellow sweet vetches (<i>Hedysarum alpinum/sulphurescens</i>)	E	T			
cut-leaved anemone (<i>Anemone multifida</i>)	E	T	TREES		
			lodgepole pine (<i>Pinus contorta</i>)	L	55
			Douglas fir (<i>Pseudotsuga menziesii</i>)	L	35

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
 † incompatible with conifer regeneration

CLIMATE

- The agroclimate varies from slight to severe heat limitations
- Temperatures are cooler and more precipitation is received during the growing season, but moisture deficits may occur (micro climate due to aspect and topography favour these sites)
- Accumulation of snow occurs but chinook activity may result in periods of moisture deficit

SOILS AND LANDSCAPES

- soils are Brunisols or Orthic Regosols
- frequently shallow veneers overlying bedrock
- landscapes can be undulating to rolling or even ridged
- landforms are highly influenced by the underlying bedrock

SOIL RECLAMATION ISSUES

- potential soil erosion by water generally ranges from severe to moderate, although heat conditions vary widely
- wind erosion potential is generally moderate although slopes exposed to chinooks may be vulnerable

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slender wheat grass
- awned wheat grass
- wild blue flax

(*Agropyron trachycaulum* var. *trachycaulum*)
(*Agropyron trachycaulum* var. *unilaterale*)
(*Linum lewisii*)

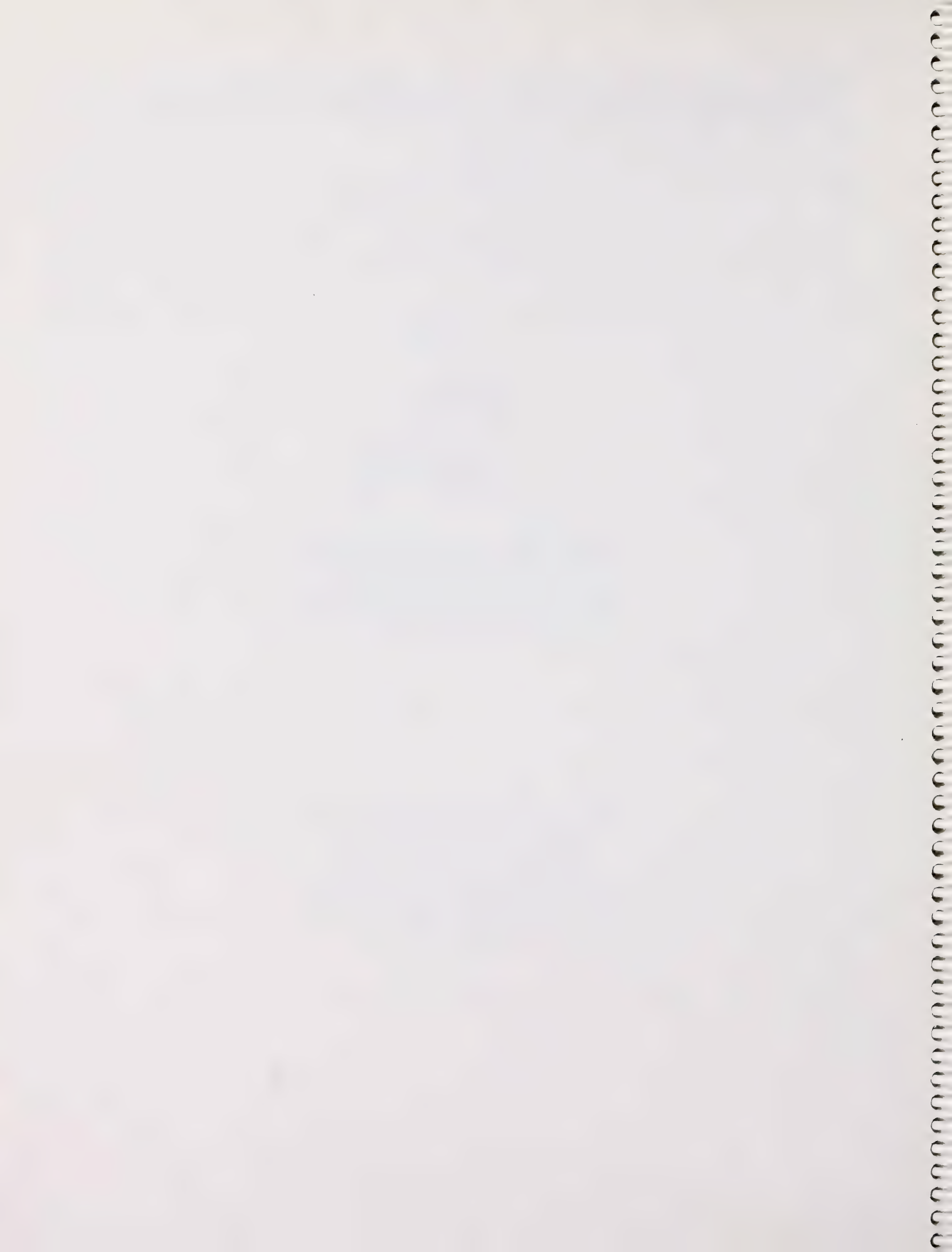
3.2



SUBALPINE SUBREGION

*The greatest beauty is organic wholeness,
the wholeness of life and things,
the divine beauty of the universe.
Love that, not man apart from that...*

Robinson Jeffers



3.2.1

GRASSLAND WEST OF PORCUPINE HILLS**COMMUNITY NAME:** rough fescue - Parry oat grass/shrubby cinquefoil - rose**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
rough fescue (<i>Festuca campestris</i>)	L	18	small leaved/low/showy everlasting (<i>Antennaria parvifolia/aprica/pulcherrima</i>)	E	7
Idaho fescue (<i>Festuca idahoensis</i>)	E	10	sticky purple geranium (<i>Geranium viscosissimum</i>)	L	4
Parry oat grass (<i>Danthonia parryi</i>)	L	7	blanket flower (<i>Gaillardia aristata</i>)	E	2
awned/ slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale</i> / <i>trachycaulum</i>)	E	3	smooth fleabane (<i>Erigeron glabellus</i>)	E	2
northern awnless brome (<i>Bromus pumpellianus</i>)	E	2	death camas (<i>Zigadenus venenosus</i>)	E	2
sun-loving sedge (<i>Carex pensylvanica</i>)	L	2	stone-seed (<i>Lithospermum rudemale</i>)	L	2
Hooker's oat grass (<i>Helictotrichon hookeri</i>)	L	2	graceful/smooth-leaved cinquefoils (<i>Potentilla gracilis/diversifolia</i>)	E	1
Kentucky bluegrass (<i>Poa pratensis</i>) [‡]	E	1	low larkspur (<i>Delphinium bicolor</i>)	E	1
Columbia needle grass (<i>Stipa columbiana</i>)	E	1	nodding onion (<i>Allium cernuum</i>)	E	1
early bluegrass (<i>Poa cusickii</i>)	E	T	wild blue flax (<i>Linum lewisii</i>)	E	T
alpine bluegrass (<i>Poa alpina</i>)	E	T	alpine aster (<i>Aster alpinus</i>)	E	T
spike trisetum (<i>Trisetum spicatum</i>)	E	T	harebell (<i>Campanula rotundifolia</i>)	E	T
purple reed grass (<i>Calamagrostis purpurescens</i>)	E	T	milk vetches (<i>Astragalus crassicaupus/ missouriensis/aboriginum/tenellus/alpinus</i>)	E	T
FORBS			loco-weeds (<i>Oxytropis sericea/ monticola/splendens/viscida</i>)	E	T
cut-leaved anemone (<i>Anemone multifida</i>)	E	12	silky lupine (<i>Lupinus sericeus</i>)	E	T
wild strawberry (<i>Fragaria virginiana</i>)	E	8	SHRUBS		
old man's whiskers (<i>Geum triflorum</i>)	E	8	bearberry (<i>Arctostaphylos uva-ursi</i>)	E	11
yellow/American sweet vetches (<i>Hedysarum sulphurescens/alpinum</i>)	E	8	shrubby cinquefoil (<i>Potentilla fruticosa</i>)	L	9
			prickly rose (<i>Rosa acicularis</i>)	L	3
			ground juniper (<i>Juniperus communis</i>)	E	1

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
[‡] native origins questionable

CLIMATE

- The agroclimate has severe heat limitations
- Accumulation of snow is higher than areas immediately to the east and south but chinook activity makes them comparable
- Although temperatures are cooler and more precipitation is received during the growing season, moisture deficits do occur
- Growing season P-PE = -150 to -250 mm

SOILS AND LANDSCAPES

- soils are predominantly Black Chernozems
- landforms are highly influenced by the underlying bedrock
- landscapes are undulating to hummocky and rolling
- soil profile development is generally 50 cm deep with 20 to 30 cm of black-colored A horizon

SOIL RECLAMATION ISSUES

- frequent strong winds cause erosion when the soil is disturbed
- potential soil erosion by water generally ranges from severe to moderate, although local conditions vary widely

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- rough fescue
- slender wheat grass
- awned wheat grass
- Idaho fescue
- alpine bluegrass
- wild blue flax

(Festuca campestris)
(Agropyron trachycaulum var. trachycaulum)
(Agropyron trachycaulum var. unilaterale)
(Festuca idahoensis)
(Poa alpina)
(Linum lewisii)

3.2.2

GRASSLAND WEST OF TURNER VALLEY

COMMUNITY NAME: rough fescue - Richardson needle grass

CLIMAX COMMUNITY DESCRIPTION (ungrazed):

**VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
rough fescue (<i>Festuca campestris</i>)	L	20	blanket flower (<i>Gaillardia aristata</i>)	E	2
sedges (<i>Carex pensylvanica</i> / <i>raymondii</i> /atrosquama)	L	17	false dandelion (<i>Agoseris glauca</i>)	E	2
mountain brome (<i>Bromus carinatus</i>)	E	10	smooth fleabane (<i>Erigeron glabellus</i>)	E	2
Richardson needle grass (<i>Stipa richardsonii</i>)	L	10	meadow parsnip (<i>Zizia aptera</i>)	L	2
Kentucky bluegrass (<i>Poa pratensis</i>)‡	E	5	common yarrow (<i>Achillea millefolium</i>)	E	1
Parry/California oat grass (<i>Danthonia parryi/californica</i>)	L	5	milk vetches (<i>Astragalus alpinus</i> / <i>dasyglottis/striatus</i>)	E	T
northern awnless brome (<i>Bromus pumpellianus</i>)	E	4	horse mint (<i>Monarda fistulosa</i>)	E	T
awned/slender wheat grass (<i>Agropyron</i> <i>trachycaulum</i> var. <i>unilaterale</i> / <i>trachycaulum</i>)	E	3	harebell (<i>Campanula rotundifolia</i>)	E	T
june grass (<i>Koeleria macrantha</i>)	E	2	northern gentian (<i>Gentianella amarella</i>)	E	T
sweet grass (<i>Hierochloa odorata</i>)	L	1	American/yellow sweet vetches (<i>Hedysarum alpinum/sulphurescens</i>)	E	T
FORBS			cream-coloured pea vine (<i>Lathyrus</i> <i>ochroleucus</i>)	E	T
yellow/slender-blue beard-tongues (<i>Penstemon confertus/procerus</i>)	E	25	silky lupine (<i>Lupinus sericeus</i>)	E	T
smooth aster (<i>Aster laevis</i>)	L	10	Canada goldenrod (<i>Solidago</i> <i>canadensis</i>)	E	T
prairie/graceful cinquefoils (<i>Potentilla pensylvanica/gracilis</i>)	E	8	blue-eyed grass (<i>Sisyrinchium</i> <i>montanum</i>)	E	T
wild strawberry (<i>Fragaria virginiana</i>)	E	7	mountain shooting shooting star (<i>Dodecatheon conjugens</i>)	E	T
sticky purple geranium (<i>Geranium</i> <i>viscosissimum</i>)	L	3	SHRUBS		
northern bedstraw (<i>Galium boreale</i>)	E	2	wolfwillow (<i>Elaeagnus commutata</i>)	E	1
			shrubby cinquefoil (<i>Potentilla fruticosa</i>)	E	1

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
‡ native origins questionable

CLIMATE

- The agroclimate has severe heat limitations
- Accumulation of snow is high and, although chinooks affect these sites, snow covers surface much of the winter
- Temperatures are cooler and good precipitation is received during the growing season; moisture deficits are low

SOILS AND LANDSCAPES

- soils are largely Orthic Eutric Brunisols with significant Chernozemic soils present
- landscapes are hummocky to rolling
- landforms are highly influenced by the underlying bedrock

SOIL RECLAMATION ISSUES

- frequent strong winds cause erosion when the soil is disturbed
- potential soil erosion by water if very high given the steeper slopes and higher growing season moisture

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- rough fescue
- slender wheat grass
- awned wheat grass
- june grass

(*Festuca campestris*)
 (*Agropyron trachycaulum* var. *trachycaulum*)
 (*Agropyron trachycaulum* var. *unilaterale*)
 (*Koeleria macrantha*)

3.2.3

SUBMESIC-SUBXERIC (CONIFER)**COMMUNITY NAME:** lodgepole pine-bearberry-hairy wildrye-lichen**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			SHRUBS		
hairy wildrye (<i>Elymus imnovatus</i>)	L	13	buffaloberry (<i>Shepherdia canadensis</i>)	L	13
awned/slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale trachycaulum</i>)	L	2	alder (<i>Alnus crispa</i>)	L	3
june grass (<i>Koeleria macrantha</i>)	E	1	bearberry (<i>Arctostaphylos uva-ursi</i>)	L	3
sedges (<i>Carex pensylvanica</i> /raymondii/ <i>atrosquama</i>)	L	1	willow (<i>Salix</i> spp.)	L	3
mountain brome (<i>Bromus carinatus</i>)	E	T	juniper (<i>Juniperus</i> spp.)	L	2
Rocky mtn. fescue (<i>Festuca saximontana</i>)	E	T	bog cranberry (<i>Vaccinium vitis-idaea</i>)	L	2
Richardson's needle grass (<i>Stipa richardsonii</i>)	L	T	rose (<i>Rosa acicularis</i>)	E	2
bluebunch wheat grass (<i>Agropyron spicatum</i>)	L	T			
FORBS			TREES		
bunchberry (<i>Cornus canadensis</i>)	L	8	lodgepole pine (<i>Pinus contorta</i>)	E	28
twinflower (<i>Linnaea borealis</i>)	L	3	Engelmann spruce (<i>Picea engelmannii</i>)	L	4
heart leaved arnica (<i>Arnica cordifolia</i>)	L	3			
palmate leaved coltsfoot (<i>Petasites palmatus</i>)	E	1	MOSSES		
dewberry (<i>Rubus pubescens</i>)	E	1	Schreber's moss (<i>Pleurozium schreberi</i>)	L	15
fireweed (<i>Epilobium angustifolium</i>)	E	1	stair step moss (<i>Hylocomium splendens</i>)	L	15
tall lungwort (<i>Mertensia paniculata</i>)	E	1	knight's plume moss (<i>Ptilium crista-castrensis</i>)	L	8
			LICHENS		
			studded leather lichen (<i>Peltigera aphthosa</i>)	L	8
			reindeer lichen (<i>Cladina</i> spp.)	L	8

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts**CLIMATE**

- The agroclimate has severe heat limitations
- Accumulation of snow is high and, although chinooks affect these sites, snow covers surface much of the winter
- Temperatures are cooler and good precipitation is received during the growing season; moisture deficits are low

SOILS AND LANDSCAPES

- soils are largely Orthic Eutric Brunisols
- landscapes are hummocky to rolling
- landforms are highly influenced by the underlying bedrock

SOIL RECLAMATION ISSUES

- frequent strong winds cause erosion when the soil is disturbed
- potential soil erosion by water is very high given the steeper slopes and higher growing season moisture

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slender wheat grass
- awned wheat grass
- bluebunch wheatgrass
- june grass
- Rocky Mtn. fescue

(*Agropyron trachycaulum* var. *trachycaulum*)

(*Agropyron trachycaulum* var. *unilaterale*)

(*Agropyron spicatum*)

(*Koeleria macrantha*)

(*Festuca saximontana*)

3.2.4

MESIC (CONIFER)**COMMUNITY NAME:** lodgepole pine-engelmann spruce-alpine fir**CLIMAX COMMUNITY DESCRIPTION (ungazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			SHRUBS		
hairy wildrye (<i>Elymus innovatus</i>)	L	2	white flowered rhododendron (<i>Rhododendron albiflorum</i>)	L	5
awned/slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale/trachycaulum</i>)	L	2	tall bilberry (<i>Vaccinium membranaceum</i>)	L	5
june grass (<i>Koeleria macrantha</i>)	E	1	blueberry (<i>Vaccinium myrtilloides</i>)	L	5
Rocky Mtn. fescue (<i>Festuca saximontana</i>)	E	1	alder (<i>Alnus crispa</i>)	L	3
fringed brome (<i>Bromus ciliatus</i>)	E	1	bog cranberry (<i>Vaccinium vitis-idaea</i>)	L	3
northern awnless brome (<i>Bromus pumpelianus</i>)	E	1	false azalea (<i>Menziesia ferruginea</i>)	L	3
sedges (<i>Carex pensylvanica</i> / <i>raymondii/atrosquama</i>)	L	1	willow (<i>Salix spp.</i>)	L	2
mountain brome (<i>Bromus carinatus</i>)	E	T	buffaloberry (<i>Shepherdia canadensis</i>)	L	1
Richardson's needle grass (<i>Stipa richardsonii</i>)	L	T			
FORBS			TREES		
fireweed (<i>Epilobium angustifolium</i>)	E	3	lodgepole pine (<i>Pinus contorta</i>)	E	20
twinflower (<i>Linnaea borealis</i>)	L	3	Engelmann spruce (<i>Picea engelmannii</i>)	L	20
bunchberry (<i>Cornus canadensis</i>)	E	2	subalpine fir (<i>Abies lasiocarpa</i>)	L	20
heart leaved arnica (<i>Arnica cordifolia</i>)	E	2			
dwarf bramble (<i>Rubus pedatus</i>)	L	2	MOSSES		
palmate leaved coltsfoot (<i>Petasites palmatus</i>)	E	1	Schreber's moss (<i>Pleurozium schreberi</i>)	L	20
dewberry (<i>Rubus pubescens</i>)	E	1	stair step moss (<i>Hylocomium splendens</i>)	L	20
mountain arnica (<i>Arnica latifolia</i>)	L	1	knight's plume moss (<i>Ptilium crista-castrensis</i>)	L	10
tall lungwort (<i>Mertensia paniculata</i>)	L	1			
			LICHENS		
			studded leather lichen (<i>Peltigera aphthosa</i>)	L	2
			reindeer lichen (<i>Cladina spp.</i>)	L	1

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts**CLIMATE**

- The agroclimate has severe heat limitations
- Accumulation of snow is high and, although chinooks affect these sites, snow covers surface much of the winter
- Temperatures are cooler and good precipitation is received during the growing season; moisture deficits are low

SOILS AND LANDSCAPES

- soils are largely Orthic Eutric Brunisols
- landscapes are hummocky to rolling
- landforms are highly influenced by the underlying bedrock

SOIL RECLAMATION ISSUES

- frequent strong winds cause erosion when the soil is disturbed
- potential soil erosion by water if very high given the steeper slopes and higher growing season moisture

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slender wheat grass
- awned wheat grass
- june grass
- Rocky Mtn. fescue

(*Agropyron trachycaulum* var. *trachycaulum*)
 (*Agropyron trachycaulum* var. *unilaterale*)
 (*Koeleria macrantha*)
 (*Festuca saximontana*)

3.2.5

HYGRIC-SUBHYDRIC**COMMUNITY NAME:** black spruce-willow-sedge**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			SHRUBS		
sedge (<i>Carex aquatilis</i> , <i>rostrata</i> , <i>atherodes</i>)	E	10-20	willow (<i>Salix</i> spp.)	E	20
tufted hairgrass (<i>Deschampsia cespitosa</i>)	E	10	dwarf birch (<i>Betula pumila</i>)	E	15
bluejoint (<i>Calamagrostis canadensis</i>)†	E	5	Labrador tea (<i>Ledum groelandicum</i>)	L	5
rush (<i>Juncus</i> spp.)	L	3	shrubby cinquefoil (<i>Potentilla fruticosa</i>)	L	3
slender wheatgrass (<i>Agropyron trachycaulum</i> var. <i>trachycaulum</i>)	E	2	TREES		
hairy wildrye (<i>Elymus innovatus</i>)	L	2	black spruce (<i>Picea mariana</i>)	L	20
fowl bluegrass (<i>Poa palustris</i>)	E	T	Engelmann spruce (<i>Picea engelmannii</i>)	L	8
fringed brome (<i>Bromus ciliatus</i>)	E	T	tamarack (<i>Larix laricina</i>)	L	2
tall manna grass (<i>Glyceria grandis</i>)	E	T	MOSESSES		
FORBS			Peat moss (<i>Sphagnum</i> spp.)	L	20
veiny meadow rue (<i>Thalictrum venulosum</i>)	E	4	tufted moss (<i>Aulacomnium palustre</i>)	L	20
dwarf scouring rush (<i>Equisetum scirpoides</i>)	E	4	Schreber's moss (<i>Pleurozium schreberi</i>)	L	5
arrow leaved coltsfoot (<i>Petasites sagittatus</i>)	E	3	stair step moss (<i>Hylocomium splendens</i>)	L	5
dwarf raspberry (<i>Rubus arcticus</i>)	E	3	knight's plume moss (<i>Ptilium crista-castrensis</i>)	L	5
purple avens (<i>Geum rivale</i>)	L	3	LICHENS		
old man's whiskers (<i>Geum triflorum</i>)	L	2	studded leather lichen (<i>Peltigera aphthosa</i>)	L	2

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
† incompatible with conifer regeneration

CLIMATE

- The agroclimate has severe heat limitations
- Accumulation of snow is high and, although chinooks affect these sites, snow covers surface much of the winter
- Temperatures are cooler and good precipitation is received during the growing season; moisture deficits are low

SOILS AND LANDSCAPES

- soils are largely Gleysols and Organics
- landscapes are hummocky to rolling
- landforms are highly influenced by the underlying bedrock

SOIL RECLAMATION ISSUES

- frequent strong winds cause erosion when the soil is disturbed
- potential soil erosion by water is very high given the steeper slopes and higher growing season moisture

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slender wheat grass
- tufted hairgrass
- fowl bluegrass

(*Agropyron trachycaulum* var. *trachycaulum*)
 (*Deschampsia cespitosa*)
 (*Poa palustris*)

3.3



ALPINE SUBREGION

*In one sense, the loss of diversity is the most
important process of environmental change.*

*I say this because it is the only process
that is wholly irreversible.*

E.O. Wilson, *Threats to Biodiversity*, Scientific American (September 1989).

3.3.1

ALPINE**COMMUNITY NAME:** mountain heather - mountain avens**CLIMAX COMMUNITY DESCRIPTION (ungazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE		
rough/northern rough fescue (<i>Festuca campestris/altaica</i>)	L	6
alpine sedges (<i>Carex albo-nigra/nardina/microglochin/podocarpa</i>)	E	5
Drummond's/slender-stemmed rush (<i>Juncus drummondii/mertensianus</i>)	L	2
bluegrass (<i>Poa glauca</i>)	E	1
alpine fescues (<i>Festuca baffinensis/brachyphylla</i>)	E	1
Rocky Mountain fescue (<i>Festuca saximontana</i>)	E	1
arctic bluegrass (<i>Poa arctica</i>)	E	1
alpine wheat grass (<i>Agropyron violaceum</i>)	E	1
alpine timothy (<i>Phleum commutatum</i>)	E	1
purple reed grass (<i>Calamagrostis purpurascens</i>)	E	1
alpine bluegrass (<i>Poa alpina</i>)	L	1
spiked woodrush (<i>Luzula spicata</i>)	L	1
spike trisetum (<i>Trisetum spicatum</i>)	E	T
sweet grass (<i>Hierochloe odorata/alpina</i>)	E	T
FORBS		
globe-flower (<i>Trollius albiflorus</i>)	L	5
shrubby/creeping beard-tongues (<i>Penstemon fruticosus/ellipticus</i>)	E	4
alpine/woolly everlasting (<i>Antennaria alpina/lanata</i>)	E	4
mountain marigold (<i>Caltha leptosepala</i>)	L	4
fleabanes (<i>Erigeron peregrinus/humilis/aureus</i>)	E	2
saxifrages (<i>Saxifraga species</i>)	E	2

SPECIES	*	% CANOPY COVER
FORBS continued		
western/flare coloured louseworts (<i>Pedicularis bracteosa/flammea</i>)	E	2
buttercup (<i>Ranunculus escholtzii</i>)	E	2
chalice-flower (<i>Anemone occidentalis</i>)	L	2
moss campion (<i>Silene acaulis</i>)	E	1
whitlow-grass (<i>Draba incerta/oligosperma/nivalis</i>)	E	1
green sorrel (<i>Rumex acetosa ssp. alpestris</i>)	E	1
cinquefoils (<i>Potentilla nivea/ovina/uniflora</i>)	E	1
alpine goldenrod (<i>Solidago multiradiata</i>)	E	1
inflated oxytrope (<i>Oxytropis podocarpa</i>)	E	1
sweet vetches (<i>Hedysarum alpinum/boreale/sulphurens</i>)	E	T
alpine aster (<i>Aster alpinus</i>)	E	T
anemone (<i>Anemone multifida/lithophila/parviflora</i>)	E	T
western meadow rue (<i>Thalictrum occidentale</i>)	E	T
SHRUBS		
white mountain heather (<i>Cassiope mertensiana</i>)	L	15
red/yellow heather (<i>Phyllodoce empetrifomis/glanduliflora</i>)	L	15
yellow mountain avens (<i>Dryas drummondii</i>)	L	10
willows (<i>Salix arctica/barrattiana/reticulata/vestita</i>)	E	4
low bilberry (<i>Vaccinium myrtillus</i>)	E	2
red elderberry (<i>Sambucus racemosa</i>)	E	1
prickly rose (<i>Rosa acicularis</i>)	E	1

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts

CLIMATE

- The agroclimate is estimated to have very severe heat limitations
- Summer temperatures are cool
- Wind has a large effect on climate
- Annual precipitation is high, exceeding 350 mm

SOILS AND LANDSCAPES

- soils are shallow Regosols with out-cropping of bedrock throughout, also wet Gleysols in low areas
- soil profiles are shallow
- landforms are strongly influenced by the underlying bedrock
- landscapes are hummocky to rolling and ridged

SOIL RECLAMATION ISSUES

- severe winds including chinooks cause a high risk of erosion on disturbed sites
- potential soil erosion by water is very high given the steep slopes and high rainfall
- hard bedrock (usually within 1.5 m of the surface) may require blasting which results in large fragments
- severe climate can hamper vegetation establishment

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

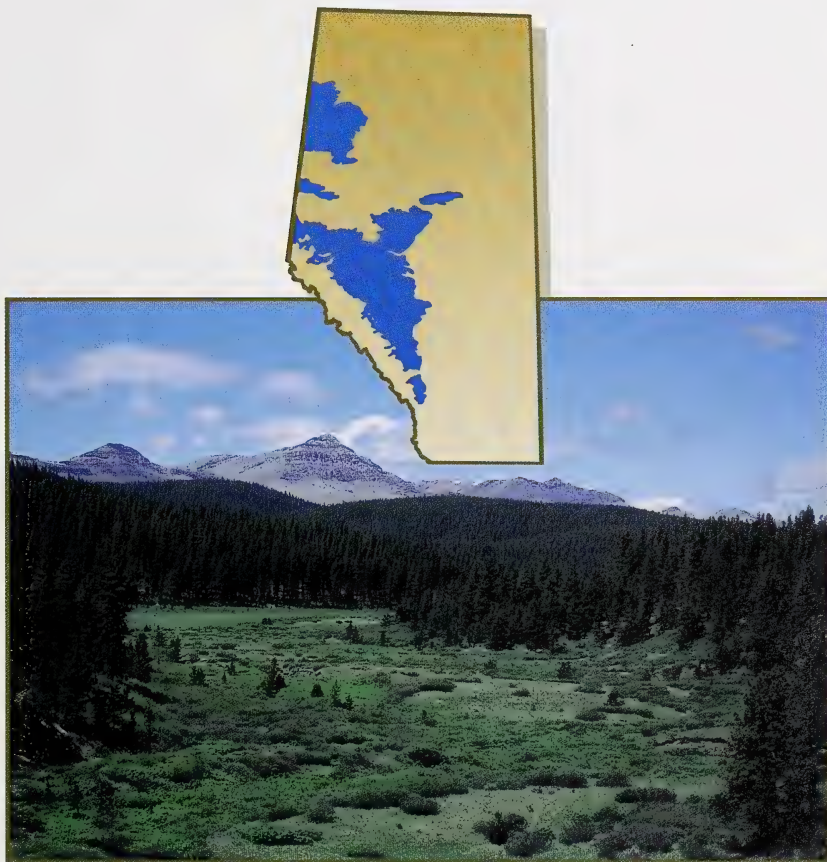
- rough fescue
- alpine bluegrass
- northern rough fescue
- Rocky Mountain fescue

(*Festuca campestris*)
 (*Poa alpina*)
 (*Festuca altaica*)
 (*Festuca saximontana*)

PART 4

foothills

NATURAL REGION



ANDREW SCHOEPF



4.1



LOWER FOOTHILLS SUBREGION

*A plant's tolerances and capabilities
in the biophysical environment
will give it either a wide or narrow address
in the infinite neighborhood of niche.*

Don Gayton, *The Wheatgrass Mechanism*.

4.1.1

SUBMESIC GRASSLAND (UPPER SOUTH FACING SLOPES WEST OF TURNER VALLEY)**COMMUNITY NAME:** rough fescue - sedge**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
rough fescue (<i>Festuca campestris</i>)	L	20	pasture sagewort (<i>Artemisia frigida</i>)	E	2
dryland sedges (<i>Carex obtusata/pennsylvanica/stenophylla</i>)	L	16	American/northern sweet vetches (<i>Hedysarum alpinum/boreale</i>)	E	2
Richardson needle grass (<i>Stipa richardsonii</i>)	E	13	Indian milk vetch (<i>Astragalus aboriginum</i>)	E	1
Parry oat grass (<i>Danthonia parryi</i>)	L	6	harebell (<i>Campanula rotundifolia</i>)	E	1
june grass (<i>Koeleria macrantha</i>)	E	4	compound fleabane (<i>Erigeron compositus</i>)	E	1
early bluegrass (<i>Poa cusickii</i>)	E	2	northern wormwood (<i>Artemisia campestris</i>)	E	1
Hooker's oat grass (<i>Helictotrichon hookeri</i>)	E	1	sticky alum-root (<i>Heuchera cylindrica</i>)	E	1
northern wheat grass (<i>Agropyron dasystachyum</i>)	L	1	smooth blue beard-tongue (<i>Penstemon nitidus</i>)	E	1
plains reed grass (<i>Calamagrostis montanensis</i>)	E	T	wild blue flax (<i>Linum lewisii</i>)	E	T
FORBS			milk vetches (<i>Astragalus crassicaarpus/drummondii/missouriensis/vexilliflexus</i>)	L	T
little club moss (<i>Selaginella densa</i>)	L	40	double bladder-pod (<i>Physaria didymocarpa</i>)	E	T
silky lupine (<i>Lupinus sericeus</i>)	E	20	early cinquefoil (<i>Potentilla concinna</i>)	E	T
cut-leaved anemone (<i>Anemone multifida</i>)	E	4			

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts

CLIMATE

- Agroclimate has severe heat limitations
- Although temperatures are cooler and more precipitation is received during the growing season, moisture deficits do occur
- Accumulation of snow is high but chinook activity results in exposed slopes at any time during the winter
- Growing season P-PE = -200 to -300 mm

SOILS AND LANDSCAPES

- soils are predominantly Orthic Eutric Brunisols and some thin Black Chernozems and Regosols
- landforms are highly influenced by the underlying bedrock
- landscapes are hummocky to rolling

SOIL RECLAMATION ISSUES

- potential erosion by water is generally severe due to exposure and steep slopes
- frequent strong winds create erosion potential when soil is disturbed
- upper slopes may have low organic content and may be vulnerable to erosion

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

• rough fescue	(<i>Festuca campestris</i>)
• june grass	(<i>Koeleria macrantha</i>)
• northern wheat grass	(<i>Agropyron dasystachyum</i>)
• wild blue flax	(<i>Linum lewisii</i>)

4.1.2

MESIC SITES (CONIFEROUS)

COMMUNITY NAME: lodgepole pine - white spruce

CLIMAX COMMUNITY DESCRIPTION (ungrazed):

**VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
hairy wild rye (<i>Elymus innovatus</i>)	L	8	Indian paint-brushes (<i>Castilleja miniata/occidentalis/rhexifolia</i>)	E	T
bluejoint (<i>Calamagrostis canadensis</i>)†	L	2	showy aster (<i>Aster conspicuous</i>)	E	T
white grained mountain rice grass (<i>Oryzopsis asperifolia</i>)	L	2	fireweed (<i>Epilobium angustifolium</i>)	E	T
purple oat grass (<i>Schizachne purpurascens</i>)	L	1	SHRUBS		
fringed brome (<i>Bromus ciliatus</i>)	E	T	cow-berry (<i>Vaccinium vitis-idaea</i>)	E	18
spike trisetum (<i>Trisetum spicatum</i>)	E	T	labrador tea (<i>Ledum groenlandicum</i>)	E	8
smooth wild rye (<i>Elymus glaucus</i>)	E	T	green alder (<i>Alnus crispa</i>)	E	5
FORBS			Canada buffalo-berry (<i>Shepherdia canadensis</i>)	E	3
twin flower (<i>Linnaea borealis</i>)	E	7	prickly/wild roses (<i>Rosa acicularis/woodsii</i>)	E	2
bunchberry (<i>Cornus canadensis</i>)	E	6	raspberry (<i>Rubus idaeus</i>)	E	2
wild strawberry (<i>Fragaria virginiana</i>)	E	5	TREES		
cream-coloured pea vine (<i>Lathyrus ochroleucus</i>)	L	5	lodgepole pine (<i>Pinus contorta</i>)	L	60
shining/twin arnica (<i>Arnica latifolia/cordifolia</i>)	E	2	white spruce (<i>Picea glauca</i>)	L	30
wintergreen (<i>Pyrola asarifolia/chlorantha/Orthilia secunda</i>)	E	2			

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
 † incompatible with conifer regeneration

CLIMATE

- Agroclimate has severe heat limitations
- Average precipitation is 460 mm, most of which occurs during the summer, making this region the second wettest area in Alberta; winter precipitation is similar to the Dry Mixedwood Subregion
- Summer temperatures are colder than the Dry Mixedwood Subregion while winter temperatures are warmer
- Chinooks have a large effect on climate in the North Saskatchewan River Valley
- Growing season P-PE = -200 to 0 mm

SOILS AND LANDSCAPES

- soils are predominantly Brunisols with some Luvisols
- landscapes are largely moraine (till), frequently undulating and hummocky
- some glaciofluvial deposits exist
- profile development is generally 65 to 85 cm deep

SOIL RECLAMATION ISSUES

- potential risk of soil erosion by water is generally severe to moderate, on steep and long slopes, because of high summer rainfall; undulating landscapes have a low risk
- risk of soil erosion by wind is generally low except in the North Saskatchewan River Basin where risk of wind erosion is high

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- spike trisetum

(*Trisetum spicatum*)

4.1.3

MESIC SITES (DECIDUOUS)**COMMUNITY NAME:** aspen - balsam poplar/rose**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
bluejoint (<i>Calamagrostis canadensis</i>)	L	9	tall lungwort (<i>Mertensia paniculata</i>)	L	2
hairy wild rye (<i>Elymus innovatus</i>)	L	8	American vetch (<i>Vicia americana</i>)	E	1
awned/slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale/trachycaulum</i>)	E	2	sweet cicely (<i>Osmorhiza depauperata</i>)	E	1
white-grained mountain rice grass (<i>Oryzopsis asperifolia</i>)	L	2	common red paint-brush (<i>Castilleja miniata</i>)	L	1
purple oat grass (<i>Schizachne purpurascens</i>)	E	1	western wood lily (<i>Lilium philadelphicum</i>)	E	T
fringed brome (<i>Bromus ciliatus</i>)	E	1	hedge nettle (<i>Stachys palustris</i>)	E	T
tickle grass (<i>Agrostis scabra</i>)	E	1			
spike trisetum (<i>Trisetum spicatum</i>)	E	T	SHRUBS		
FORBS			prickly/wild roses (<i>Rosa acicularis/woodsii</i>)	L	19
wild sarsaparilla (<i>Aralia nudicaulis</i>)	L	15	raspberry (<i>Rubus idaeus</i>)	E	7
cream-coloured pea vine (<i>Lathyrus ochroleucus</i>)	L	8	low-bush cranberry (<i>Viburnum edule</i>)	E	4
bunchberry (<i>Cornus canadensis</i>)	E	6	green alder (<i>Alnus crispa</i>)	E	3
fireweed (<i>Epilobium angustifolium</i>)	E	4	willows (<i>Salix scouleriana/drummondiana/glauca/bebbiana</i>)	E	3
showy aster (<i>Aster conspicuus</i>)	E	4	Canada buffalo-berry (<i>Shepherdia canadensis</i>)	E	1
twin-flower (<i>Linnaea borealis</i>)	E	4	bracted honeysuckle (<i>Lonicera involucrata</i>)	E	1
lily-of-the-valley (<i>Maianthemum canadense</i>)	E	4			
veiny meadow rue (<i>Thalictrum venulosum</i>)	E	3	TREES		
dewberry (<i>Rubus pubescens</i>)	E	2	trembling aspen (<i>Populus tremuloides</i>)	L	56
Lindley's aster (<i>Aster ciliolatus</i>)	E	2	balsam poplar (<i>Populus balsamifera</i>)	L	10
			white birch (<i>Betula papyrifera</i>)	E	10

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts

CLIMATE

- Agroclimate has severe heat limitations
- Average precipitation is 460 mm, most of which occurs during the summer, making this region the second wettest area in Alberta, winter precipitation is similar to that of the Dry Mixedwood Subregion
- Summer temperature are colder than the Dry Mixedwood Subregion while winter temperatures are warmer
- Chinooks have a large effect on climate in the North Saskatchewan River Valley
- Growing season P-PE = -200 to 0 mm

SOILS AND LANDSCAPES

- soils are predominantly Luvisols with poorly drained areas containing Gleysolic and Organic soils
- landscapes are predominantly Cordilleran till with the surface expression controlled by bedrock
- profile development generally 65 cm to 85 cm with 15 to 20 cm of topsoil

SOIL RECLAMATION ISSUES

- potential risk of soil erosion by water is generally severe to moderate, on steep and long slopes, because of high summer rainfall; undulating landscapes have a low risk
- risk of soil erosion by wind is generally low except in the North Saskatchewan River Valley

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slender wheat grass
- awned wheat grass
- American vetch

(*Agropyron trachycaulum* var. *trachycaulum*)
 (*Agropyron trachycaulum* var. *unilaterale*)
 (*Vicia americana*)

4.1.4

SUBHYGRIC
(GRASSLANDS WEST OF TURNER VALLEY)

COMMUNITY NAME: bog birch/rough fescue - lowland sedge

CLIMAX COMMUNITY DESCRIPTION (ungrazed):

**VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS		
sedges (<i>Carex raymondii/aquatilis/rostrata</i>)	L	13	common yarrow (<i>Achillea millefolium</i>)	E	13
awned/slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale/trachycaulum</i>)	E	10	graceful cinquefoil (<i>Potentilla gracilis</i>)	E	10
rough fescue (<i>Festuca campestris</i>)	L	7	western willow aster (<i>Aster hesperius</i>)	E	10
tufted hair grass (<i>Deschampsia cespitosa</i>)	E	4	wild strawberry (<i>Fragaria virginiana</i>)	E	8
Kentucky blue grass (<i>Poa pratensis</i>)‡	E	2	tall larkspur (<i>Delphinium glaucum</i>)	L	5
California oat grass (<i>Danthonia californica</i>)	E	2	shining arnica (<i>Arnica fulgens</i>)	E	3
fringed brome (<i>Bromus ciliatus</i>)	E	2	northern valerian (<i>Valeriana dioica</i>)	L	3
bluejoint (<i>Calamagrostis canadensis</i>)	E	2	elephant head (<i>Pedicularis groenlandica</i>)	E	2
sheathed/hair-like sedge (<i>Carex vaginata/capillaris</i>)	E	2	dwarf raspberry (<i>Rubus arcticus</i>)	L	2
tickle grass (<i>Agrostis scabra</i>)	E	1	purple avens (<i>Geum rivale</i>)	E	1
slough grass (<i>Beckmannia syzigachne</i>)	E	1	northern gentian (<i>Gentianella amarella</i>)	E	T
tall manna grass (<i>Glyceria grandis</i>)	E	1	leafy arnica (<i>Arnica chamissonis</i>)	E	T
alpine foxtail (<i>Alopecurus occidentalis</i>)	E	1	wild mint (<i>Mentha arvensis</i>)	E	T
fowl bluegrass (<i>Poa palustris</i>)	E	1	balsam groundsel (<i>Senecio pauperculus</i>)	E	T
close-sheathed/sheathed cotton grass (<i>Eriophorum brachyantherum/vaginatum</i>)	E	1	hedge nettle (<i>Stachys palustris</i>)	E	T
nodding brome (<i>Bromus anomalus</i>)	E	T	white camus (<i>Zigadenus elegans</i>)	L	T
northern wheat grass (<i>Agropyron dasystachyum</i>)	E	T			
sweet grass (<i>Hierochloe odorata</i>)	E	T	SHRUBS		
alpine timothy (<i>Phleum commutatum</i>)	E	T	bog birch (<i>Betula glandulosa</i>)	L	6
			willows (<i>Salix candida/ maccalliana/glauca</i>)	E	5
			shrubby cinquefoil (<i>Potentilla fruticosa</i>)	E	3

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
‡ native origins questionable

CLIMATE

- Agroclimate has severe heat limitations
- Temperatures are cooler and more precipitation occurs during the growing season, thus moisture deficits are less frequent
- Accumulation of snow is higher, although chinook activity results in considerable draw down; the birch - fescue cover reduces snow movement
- Growing season P-PE = -100 to -150 mm
- soils are predominantly Orthic Melanic Brunisols with lesser amounts of Gleysolic or Organic soils

SOILS AND LANDSCAPES

- landforms are influenced by the underlying bedrock
- landscapes are undulating to hummocky

SOIL RECLAMATION ISSUES

- potential soil erosion by water is generally moderate to severe although local conditions vary widely
- strong chinook winds may cause some erosion problems on disturbed soils

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- tufted hair grass
- slender wheat grass
- fowl bluegrass
- rough fescue
- northern wheat grass
- slough grass
- awned wheat grass

- (*Deschampsia cespitosa*)
- (*Agropyron trachycaulum* var. *trachycaulum*)
- (*Poa palustris*)
- (*Festuca campestris*)
- (*Agropyron dasystachyum*)
- (*Bechmannia syzigachne*)
- (*Agropyron trachycaulum* var. *unilaterale*)

4.1.5

SUBHYGRIC - HYGRIC SITES

COMMUNITY NAME: black spruce-marsh reed grass - lowland sedge
(combines lowland sedge and reed grass community types)

CLIMAX COMMUNITY DESCRIPTION (ungrazed):

**VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
bluejoint (<i>Calamagrostis canadensis</i>)†	E	55	dwarf raspberry (<i>Rubus arcticus</i>)	L	1
water sedge (<i>Carex aquatilis</i>)	L	45	grass-of-parnassus (<i>Parnassia palustris</i>)	L	1
awned sedge (<i>Carex atherodes</i>)	L	10	cloudberry (<i>Rubus chamaemorus</i>)	E	1
beaked sedge (<i>Carex rostrata</i>)	L	10	balsam groundsel (<i>Senecio pauperculus</i>)	E	T
manna grasses (<i>Glyceria striata/borealis/grandis</i>)	E	2	brook ragwort (<i>Senecio triangularis</i>)	E	T
sedges (<i>Carex raymondii/aurea/capillaris</i>)	E	1	rush aster (<i>Aster borealis</i>)	E	T
slough grass (<i>Beckmannia syzigachne</i>)	E	1	hedge nettle (<i>Stachy palustris</i>)	E	T
northern reed grass (<i>Calamagrostis inexpansa</i>)†	L	1	SHRUBS		
narrow reed grass (<i>Calamagrostis stricta</i>)†	L	1	labrador tea (<i>Ledum groelandicum</i>)	L	20
fowl bluegrass (<i>Poa palustris</i>)	E	T	willows (<i>Salix candida/glauca/maccalliana</i>)	E	17
tufted hair grass (<i>Deschampsia cespitosa</i>)	E	T	bog birch (<i>Betula glandulosum</i>)	L	10
common reed grass (<i>Phragmites australis</i>)	E	T	bog cranberry (<i>Vaccinium vitis-idaea</i>)	E	3
FORBS			currants (<i>Ribes lacustre/hudsonianum</i>)	E	1
wild mint (<i>Mentha arvensis</i>)	E	1	TREES		
marsh skullcap (<i>Scutellaria galericulata</i>)	E	1	black spruce (<i>Picea mariana</i>)	L	20
northern willow herb (<i>Epilobium ciliatum</i>)	E	1	tamarack (<i>Larix laricina</i>)	L	11
western dock (<i>Rumex occidentalis</i>)	E	1	MOSSES		
			peat moss (<i>Sphagnum</i>)	L	15

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
† incompatible with conifer regeneration

CLIMATE

- Agroclimate has severe heat limitations
- Average precipitation is 460 mm, most of which occurs during the summer, making this region the second wettest area in Alberta; winter precipitation is similar to the Dry Mixedwood Subregion
- Summer temperatures are colder than the Dry Mixedwood Subregion while winter temperatures are warmer
- Growing season P-PE = -50 to 0 mm

SOILS AND LANDSCAPES

- soils are dominantly Gleysols with some Organic
- depressional or discharge areas in undulating and hummocky morainal tills

SOIL RECLAMATION ISSUES

- despite high rainfall, risk of water erosion is low to moderate because of long slopes
- the risk of soil erosion by wind is low
- cool or cold soils may inhibit germination and vigor of seedlings

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slough grass
- fowl bluegrass
- tufted hair grass

(*Beckmannia syzigachne*)
 (*Poa palustris*)
 (*Deschampsia cespitosa*)

4.2



UPPER FOOTHILLS SUBREGION

Nature, once a harsh and feared master, now lies in subjection, and needs protection against man's powers. Yet because man, no matter what intellectual and technical heights he may scale, remains embedded in nature, the balance has shifted against him, too, and the threat that he poses to the earth is a threat to him as well.

Jonathan Schell, *The Fate of the Earth* (1982).

4.2.1

SUBXERIC-SUBMESIC (CONIFER)**COMMUNITY NAME:** lodgepole pine-bearberry-hairy wildrye-lichen**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			SHRUBS		
hairy wildrye (<i>Elymus innovatus</i>)	L	13	buffaloberry (<i>Shepherdia canadensis</i>)	L	13
awned/slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale</i> / <i>trachycaulum</i>)	L	2	green alder (<i>Alnus crispa</i>)	L	3
sedges (<i>Carex pensylvanica</i> / <i>raymondii</i> / <i>atrosquama</i>)	L	1	bearberry (<i>Arctostaphylos uva-ursi</i>)	L	3
june grass (<i>Koeleria macrantha</i>)	E	1	willow (<i>Salix</i> spp.)	L	3
Rocky mtn fescue (<i>Festuca saximontana</i>)	E	1	juniper (<i>Juniperus</i> spp.)	L	2
mountain brome (<i>Bromus carinatus</i>)	E	T	bog cranberry (<i>Vaccinium vitis-idaea</i>)	L	2
bluebunch wheat grass (<i>Agropyron spicatum</i>)	L	T	prickly rose (<i>Rosa acicularis</i>)	E	2
FORBS			TREES		
bunchberry (<i>Cornus canadensis</i>)	L	8	lodgepole pine (<i>Pinus contorta</i>)	E	28
twinflower (<i>Linnaea borealis</i>)	L	3	Engelmann spruce (<i>Picea engelmannii</i>)	L	4
heart leaved arnica (<i>Arnica cordifolia</i>)	L	3	MOSSES		
showy aster (<i>Aster conspicuus</i>)	E	2	Schreber's moss (<i>Pleurozium schreberi</i>)	L	15
palmate leaved coltsfoot (<i>Petasites palmatus</i>)	E	1	stair step moss (<i>Hylocomium splendens</i>)	L	15
dewberry (<i>Rubus pubescens</i>)	E	1	knight's plume moss (<i>Ptilium crista-castrensis</i>)	L	8
fireweed (<i>Epilobium angustifolium</i>)	E	1	LICHENS		
tall lungwort (<i>Mertensia paniculata</i>)	E	1	studded leather lichen (<i>Peltigera aphthosa</i>)	L	8
			reindeer lichen (<i>Cladina</i> spp.)	L	8

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts

CLIMATE

- The agroclimate has severe heat limitations
- Accumulation of snow is high and, although chinooks affect these sites, snow covers surface much of the winter
- Temperatures are cooler and good precipitation is received during the growing season; moisture deficits are low

SOILS AND LANDSCAPES

- soils are largely Orthic Eutric Brunisols
- landscapes are hummocky to rolling
- landforms are highly influenced by the underlying bedrock

SOIL RECLAMATION ISSUES

- frequent strong winds cause erosion when the soil is disturbed
- potential soil erosion by water is very high given the steeper slopes and higher growing season precipitation

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slender wheat grass
- awned wheat grass
- bluebunch wheatgrass
- june grass
- Rocky Mtn. fescue

(*Agropyron trachycaulum* var. *trachycaulum*)
(*Agropyron trachycaulum* var. *unilaterale*)
(*Agropyron spicatum*)
(*Koeleria macrantha*)
(*Festuca saximontana*)

4.2.2

MESIC-SUBHYGRIC (CONIFER)**COMMUNITY NAME:** lodgepole pine-white spruce-tall bilberry-bracted honeysuckle**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
bluejoint (<i>Calamagrostis canadensis</i>)†	E	4	tall lungwort (<i>Mertensia paniculata</i>)	E	1
hairy wildrye (<i>Elymus innovatus</i>)	L	3	bishop's cap (<i>Mitella nuda</i>)	L	1
awned/slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale/trachycaulum</i>)	L	2			
sedges (<i>Carex pensylvanica</i> /raymondii/ <i>atrosquama</i>)	L	1	SHRUBS		
june grass (<i>Koeleria macrantha</i>)	E	1	low bush cranberry (<i>Viburnum edule</i>)	L	10
Rocky Mtn. fescue (<i>Festuca saximontana</i>)	E	1	bracted honeysuckle (<i>Lonicera involucrata</i>)	L	10
mountain brome (<i>Bromus carinatus</i>)	E	T	green alder (<i>Alnus crispa</i>)	L	3
			willow (<i>Salix</i> spp.)	L	3
FORBS			wild red raspberry (<i>Rubus ideaus</i>)	E	2
bunchberry (<i>Cornus canadensis</i>)	L	8	bog cranberry (<i>Vaccinium vitis-idaea</i>)	L	2
wild sarsaparilla (<i>Aralia nudicaulis</i>)	L	5	prickly rose (<i>Rosa acicularis</i>)	E	2
common pink wintergreen (<i>Pyrola asarifolia</i>)	L	4			
twinflower (<i>Linnaea borealis</i>)	L	3	TREES		
heart leaved arnica (<i>Arnica cordifolia</i>)	L	3	lodgepole pine (<i>Pinus contorta</i>)	E	20
showy aster (<i>Aster conspicuus</i>)	E	2	white spruce (<i>Picea glauca</i>)	L	10
cow parsnip (<i>Heracleum lanatum</i>)	E	2	aspen (<i>Populus tremuloides</i>)	E	10
oak fern (<i>Gymnocarpium dryopteris</i>)	L	2	balsam poplar (<i>Populus balsamifera</i>)	E	5
palmate leaved coltsfoot (<i>Petasites palmatus</i>)	E	1			
dewberry (<i>Rubus pubescens</i>)	E	1	MOSESSES		
fireweed (<i>Epilobium angustifolium</i>)	E	1	Schreber's moss (<i>Pleurozium schreberi</i>)	L	15
			stair step moss (<i>Hylocomium splendens</i>)	L	15
			knight's plume moss (<i>Ptilium crista-castrensis</i>)	L	8

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
 † incompatible with conifer regeneration

CLIMATE

- The agroclimate has severe heat limitations
- Accumulation of snow is high and, although chinooks affect these sites, snow covers surface much of the winter
- Temperatures are cooler and good precipitation is received during the growing season; moisture deficits are low

SOILS AND LANDSCAPES

- soils are largely Orthic Eutric Brunisols
- landscapes are hummocky to rolling
- landforms are highly influenced by the underlying bedrock

SOIL RECLAMATION ISSUES

- frequent strong winds cause erosion when the soil is disturbed
- potential soil erosion by water is very high given the steeper slopes and higher growing season moisture

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slender wheat grass
- awned wheat grass
- june grass
- Rocky Mtn. fescue

(*Agropyron trachycaulum* var. *trachycaulum*)
 (*Agropyron trachycaulum* var. *unilaterale*)
 (*Koeleria macrantha*)
 (*Festuca saximontana*)

4.2.3

MESIC - SUBHYGRIC (VALLEY BOTTOMS)**COMMUNITY NAME:** rough fescue - sedge - tufted hair grass**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
pasture/rush-like sedges (<i>Carex praticola/scirpoidea</i>)	L	25	old man's whiskers (<i>Geum triflorum</i>)	E	2
rough/northern rough fescue (<i>Festuca campestris/altaica</i>)	L	15	early blue violet (<i>Viola adunca</i>)	E	1
tufted hair grass (<i>Deschampsia cespitosa</i>)	L	15	sweet vetches (<i>Hedysarum alpinum/boreale sulphurescens</i>)	E	1
beaked/water sedge (<i>Carex rostrata/aquatilis</i>)	L	10	northern gentian (<i>Gentianella amarella</i>)	E	1
hairy wild rye (<i>Elymus innovatus</i>)	E	8	alpine bistort (<i>Polygonum viviparum</i>)	E	1
awned/slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale/trachycaulum</i>)	E	5	tall larkspur (<i>Delphinium glaucum</i>)	L	1
awned sedge (<i>Carex atherodes</i>)	L	5	monkshood (<i>Aconitum delphinifolium</i>)	L	1
tickle grass (<i>Agrostis scabra</i>)	E	2	heart-leaved buttercup (<i>Ranunculus cardiophyllus</i>)	L	1
wood rush (<i>Luzula parviflora</i>)	L	2	elephant head (<i>Pedicularis groelandica</i>)	L	1
fringed brome (<i>Bromus ciliatus</i>)	E	T	grass of parnassis (<i>Parnassia palustris</i>)	L	1
sweet grass (<i>Hierochloa odorata</i>)	E	T	cream-coloured pea vine (<i>Lathyrus ochroleucus</i>)	E	T
bluejoint (<i>Calamagrostis canadensis</i>)	E	T	American vetch (<i>Vicia americana</i>)	E	T
northern awnless brome (<i>Bromus pumpellianus</i>)	E	T	common yarrow (<i>Achillea millefolium</i>)	E	T
tall mannagrass (<i>Glyceria grandis</i>)	L	T	alpine aster (<i>Aster alpinus</i>)	E	T
fowl bluegrass (<i>Poa palustris</i>)	E	T	mountain/saline shooting stars (<i>Dodecatheon conjugens/pulchellum</i>)	E	T
slough grass (<i>Beckmannia syzigachne</i>)	L	T	graceful/smooth-leaved cinquefoils (<i>Potentilla gracilis/diversifolia</i>)	E	T
FORBS			SHRUBS		
slender blue beard-tongue (<i>Penstemon procerus</i>)	E	7	bog birch (<i>Betula glandulosa</i>)	E	22
veiny meadow rue (<i>Thalictrum venulosum</i>)	E	6	willow (<i>Salix spp.</i>)	E	15
fireweed (<i>Epilobium angustifolium</i>)	E	5	shrubby cinquefoil (<i>Potentilla fruticosa</i>)	E	2

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts

CLIMATE

- Agroclimate is estimated to have very severe heat limitations
- Average annual precipitation is near 540 mm, most of which (340 mm) occurs during the summer, often creating a moisture surplus
- Summer temperatures are cooler than the Lower Foothills Subregion but warmer in the winter
- Winds have a large effect on climate in the North Saskatchewan and Athabasca River Valleys

SOILS AND LANDSCAPES

- soils are largely Brunisols, Luvisols and Cumulic Regosols
- profile development is generally 85 cm deep
- most landforms are influenced by the underlying bedrock; veneers and blankets of Cordilleran till over Tertiary and Cretaceous-aged bedrock of varying lithology dominate with significant colluvial veneers

SOIL RECLAMATION ISSUES

- potential soil erosion by water is very high given the steep slopes and high summer rainfall
- severe chinook winds in North Saskatchewan and Athabasca River valleys cause a high risk of erosion on disturbed sites
- shallow to hard bedrock may result in blasting and large fragments to contend with

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- tufted hair grass
- slender wheat grass
- awned wheat grass
- rough fescue
- American vetch
- slough grass
- fowl bluegrass

(*Deschampsia cespitosa*)
 (*Agropyron trachycaulum* var. *trachycaulum*)
 (*Agropyron trachycaulum* var. *unilaterale*)
 (*Festuca campestris*)
 (*Vicia americana*)
 (*Beckmannia syzigachne*)
 (*Poa palustris*)

4.2.4

HYGRIC-SUBHYDRIC

COMMUNITY NAME: black spruce-willow-sedge

CLIMAX COMMUNITY DESCRIPTION (ungrazed):

**VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			SHRUBS		
sedge (<i>Carex aquatilis</i> , <i>rostrata</i> , <i>atherodes</i>)	E	10-20	willow (<i>Salix</i> spp.)	E	20
tufted hairgrass (<i>Deschampsia cespitosa</i>)	E	10	dwarf birch (<i>Betula pumila</i>)	L	15
bluejoint (<i>Calamagrostis canadensis</i>)†	E	5	Labrador tea (<i>Ledum groelandicum</i>)	L	5
rush (<i>Juncus</i> spp.)	L	3	shrubby cinquefoil (<i>Potentilla fruticosa</i>)	L	3
slender wheatgrass (<i>Agropyron trachycaulum</i> var. <i>trachycaulum</i>)	E	2	small bog cranberry (<i>Oxycoccus microcarpus</i>)	L	2
hairy wildrye (<i>Elymus innovatus</i>)	L	2	TREES		
fringed brome (<i>Bromus ciliatus</i>)	E	1	black spruce (<i>Picea mariana</i>)	L	20
fowl bluegrass (<i>Poa palustris</i>)	E	1	tamarack (<i>Larix laricina</i>)	L	8
slough grass (<i>Beckmannia syzigachne</i>)	E	T	MOSSES		
FORBS			Peat moss (<i>Sphagnum</i> spp.)	L	20
dwarf scouring rush (<i>Equisetum scirpoides</i>)	E	4	tufted moss (<i>Aulacomnium palustre</i>)	L	20
three leaved Solomon's seal (<i>Smilica trifolia</i>)	L	4	golden moss (<i>Tomenthypnum nitens</i>)	L	5
dwarf raspberry (<i>Rubus arcticus</i>)	E	3	brown moss (<i>Drepanocladus</i> spp.)	L	5
veiny meadow rue (<i>Thalictrum venulosum</i>)	E	3	LICHENS		
common horsetail (<i>Equisetum arvense</i>)	E	2	reindeer lichen (<i>Cladina</i> spp.)	L	2
buck bean (<i>Menyanthes trifolia</i>)	E	2			
cloudberry (<i>Rubus chamaemorus</i>)	L	2			

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
 † incompatible with conifer regeneration

CLIMATE

- The agroclimate has severe heat limitations
- Accumulation of snow is high and, although chinooks affect these sites, snow covers surface much of the winter
- Temperatures are cooler and good precipitation is received during the growing season; moisture deficits are low

SOILS AND LANDSCAPES

- soils are largely Gleysols and Organics
- landscapes are hummocky to rolling
- landforms are highly influenced by the underlying bedrock

SOIL RECLAMATION ISSUES

- frequent strong winds cause erosion when the soil is disturbed
- potential soil erosion by water is very high given the steeper slopes and higher growing season moisture

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slender wheat grass
- tufted hairgrass
- slough grass
- fowl bluegrass

(*Agropyron trachycaulum* var. *trachycaulum*)
 (*Deschampsia cespitosa*)
 (*Beckmannia syzigachne*)
 (*Poa palustris*)

PART 5

boreal forest

NATURAL REGION



GERALD HAEKEL



5.1



DRY
MIXEDWOOD
SUBREGION

We do not sustain the forest; the forest sustains us.

Herb Hammond, *Seeing the Forest Among the Trees* (1991)

5.1.1

SUBMESIC MOISTURE (SANDY SOILS)**COMMUNITY NAME:** aspen/rose - alder/mountain rice grass**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
mountain rice grass (<i>Oryzopsis asperifolia</i>)	L	25	American vetch (<i>Vicia americana</i>)	E	1
hairy wild rye (<i>Elymus innovatus</i>)	L	10	purple/ascending purple milk vetches (<i>Astragalus dasyglottis/striatus</i>)	E	T
fringed brome (<i>Bromus ciliatus</i>)	E	5	cow-wheat (<i>Melampyrum lineare</i>)	E	T
awned/slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale</i> / <i>trachycaulum</i>)	E	2	hairy golden aster (<i>Heterotheca villosa</i>)	E	T
purple oat grass (<i>Schizachne purpurascens</i>)	E	1	harebell (<i>Campanula rotundifolia</i>)	E	T
northern wheat grass (<i>Agropyron dasystachyum</i>)	E	T	yellow evening primrose (<i>Oenothera biennis</i>)	E	T
june grass (<i>Koeleria macrantha</i>)	E	T	mountain goldenrod (<i>Solidago spathulata</i>)	E	T
Rocky Mountain fescue (<i>Festuca saximontana</i>)	E	T			
hay sedge (<i>Carex siccata</i>)	E	T	SHRUBS		
FORBS			green alder (<i>Alnus crispa</i>)	L	35
bunchberry (<i>Cornus canadensis</i>)	E	30	prickly/wild rose (<i>Rosa acicularis/woodsii</i>)	L	12
wild sarsaparilla (<i>Aralia nudicaulis</i>)	L	26	bearberry (<i>Arctostaphylos uva-ursi</i>)	E	4
spreading dogbane (<i>Apocynum androsaemifolium</i>)	E	10	common blue berry (<i>Vaccinium myrtilloides</i>)	E	4
twin-flower (<i>Linnaea borealis</i>)	E	4	pin cherry (<i>Prunus pensylvanica</i>)	E	2
wild strawberry (<i>Fragaria virginiana</i>)	E	2	saskatoon (<i>Amalanchier alnifolia</i>)	E	2
lily-of-the-valley (<i>Maianthemum canadense</i>)	E	2	Canada buffalo-berry (<i>Shepherdia canadensis</i>)	E	2
fireweed (<i>Epilobium angustifolium</i>)	E	1			
pea vine (<i>Lathyrus ochroleucus/venosus</i>)	L	1	TREES		
American vetch (<i>Vicia americana</i>)	E	1	trembling aspen (<i>Populus tremuloides</i>)	L	60
			jack pine (<i>Pinus banksiana</i>)	E	13
			white spruce (<i>Picea glauca</i>)	E	2
			balsam poplar (<i>Populus balsamifera</i>)	E	2

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts**CLIMATE**

- Agroclimate has slight to moderate heat limitations
- Temperature is cooler and moisture is greater than in the Black Soil Zone of the Parkland region
- Summer temperatures are warmer than in all other Boreal Subregions; during the winter, only the Central Mixedwood Subregion is colder
- Growing season P-PE = -200 to -250 mm

SOILS AND LANDSCAPES

- predominantly Gray and Dark Gray Luvisols and Orthic Eutric Brunisols
- landscapes are predominantly undulating hummocky moraines or glaciolacustrine blankets over till

SOIL RECLAMATION ISSUES

- profiles are generally 65 mm deep with 10 to 30 cm of top soil
- the risk of soil erosion by water is generally low
- the risk of soil erosion by wind is moderate to high

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slender wheat grass
- awned wheat grass
- northern wheat grass
- june grass
- Rocky Mountain fescue
- American vetch

(Agropyron trachycaulum var. trachycaulum)
(Agropyron trachycaulum var. unilaterale)
(Agropyron dasystachyum)
(Koeleria macrantha)
(Festuca saximontana)
(Vicia americana)

5.1.2

MESIC SITES**COMMUNITY NAME:** aspen/rose (white spruce succession)**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE		
hairy wild rye (<i>Elymus innovatus</i>)	L	15
bluejoint (<i>Calamagrostis canadensis</i>)†	L	3
purple oat grass (<i>Schizachne purpurascens</i>)	L	3
awned wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale</i>)	E	2
nodding brome (<i>Bromus anomalus</i>)	E	2
fringed brome (<i>Bromus ciliatus</i>)	E	1
FORBS		
showy aster (<i>Aster conspicuus</i>)	E	9
wild sarsaparilla (<i>Aralia nudicaulis</i>)	E	9
fireweed (<i>Epilobium angustifolium</i>)	E	9
bunchberry (<i>Cornus canadensis</i>)	E	6
cream-coloured pea vine (<i>Lathyrus ochroleucus</i>)	E	6
twin-flower (<i>Linnaea borealis</i>)	E	6
Lindley's aster (<i>Aster ciliolatus</i>)	E	3
fairy-bells (<i>Disporum trachycarpum</i>)	E	2
lily-of-the-valley (<i>Maianthemum canadense</i>)	E	2
baneberry (<i>Actaea rubra</i>)	E	2
veiny meadow rue (<i>Thalictrum venulosum</i>)	E	2
American vetch (<i>Vicia americana</i>)	L	2
western wood lily (<i>Lilium philadelphicum</i>)	E	1
cow parsnip (<i>Heracleum lanatum</i>)	E	1

SPECIES	*	% CANOPY COVER
FORBS <i>continued</i>		
wild white geranium (<i>Geranium richardsonii</i>)	E	T
harebell (<i>Campanula rotundifolia</i>)	E	T
tall lungwort (<i>Mertensia paniculata</i>)	E	T
anemone (<i>Anemone canadensis</i> / <i>patens/multifida</i>)	E	T
smooth fleabane (<i>Erigeron glabellus</i>)	E	T
Canada goldenrod (<i>Solidago canadensis</i>)	E	T
hedge nettle (<i>Stachys palustris</i>)	E	T
SHRUBS		
prickly/wild rose (<i>Rosa acicularis/woodsii</i>)	E	25
green alder (<i>Alnus crispa</i>)	E	6
Canada buffalo-berry (<i>Shepherdia canadensis</i>)	E	6
raspberry (<i>Rubus idaeus</i>)	E	5
bush cranberries (<i>Viburnum edule/opulus</i>)	E	5
red osier dogwood (<i>Cornus stolonifera</i>)	E	1
honeysuckles (<i>Lonicera dioicia/ involucrata</i>)	E	1
beaked hazelnut (<i>Corylus cornuta</i>)	E	1
TREES		
trembling aspen (<i>Populus tremuloides</i>)	L	65
white spruce (<i>Picea glauca</i>)	E	10
balsam poplar (<i>Populus balsamifera</i>)	E	3
paper birch (<i>Betula papyrifera</i>)	E	2

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
 † incompatible with conifer regeneration

CLIMATE

- Agroclimate has slight to moderate heat limitations
- The temperature is cooler and moisture is greater than in the Black Soil Zone of the Parkland region
- Summer temperatures are warmer than all other Boreal Subregions; during the winter, only the Central Mixedwood Subregion is colder
- Growing season P-PE = -150 to -250 mm

SOILS AND LANDSCAPES

- mainly Dark Gray and Gray Luvisols with Eutric Brunisols and occasional Dark Gray Chernozems and Solonetzic soils associated with the Edmonton formation soft rock
- landscapes are predominantly undulating to hummocky moraines and glaciolacustrine blankets over till
- profile development is to 70 cm deep
- soils have 10 to 30 cm of dark gray colored A horizon
- cultivated Gray Luvisol soils have a dark colored Ap horizon but native soils have a gray, leached (Ae) horizon

SOIL RECLAMATION ISSUES

- potential risk of soil erosion by water is generally moderate
- the potential risk of soil erosion by wind is low
- Edmonton formation soft rock is typically sodic

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- awned wheat grass
- American vetch

(*Agropyron trachycaulum* var. *unilaterale*)
(*Vicia americana*)

5.1.3

SUBHYGRIC - HYGRIC SITES

COMMUNITY NAME: black spruce-reed grass - lowland sedge - baltic rush

CLIMAX COMMUNITY DESCRIPTION (ungrazed):

**VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE		
northern/narrow-leaved reed grasses (<i>Calamagrostis inexpansa/stricta</i>)†	L	55
water sedge (<i>Carex aquatilis</i>)	L	10
awned sedge (<i>Carex atherodes</i>)	L	10
beaked sedge (<i>Carex rostrata</i>)	L	10
tall/northern manna grasses (<i>Glyceria grandis/borealis</i>)	E	2
baltic rush (<i>Juncus balticus</i>)	L	2
small-fruited bulrush (<i>Scirpus microcarpus</i>)	L	2
slough grass (<i>Beckmannia syzigachen</i>)	E	1
fowl bluegrass (<i>Poa palustris</i>)	E	1
tufted hair grass (<i>Deschampsia cespitosa</i>)	E	T
hairy-fruit sedge (<i>Carex lasiocarpa</i>)	E	T
FORBS		
wild mint (<i>Mentha arvensis</i>)	E	1
marsh skullcap (<i>Scutellaria galericulata</i>)	E	1
Philadelphia fleabane (<i>Erigeron philadelphicus</i>)	E	1

SPECIES	*	% CANOPY COVER
FORBS <i>continued</i>		
northern willow herb (<i>Epilobium ciliatum</i>)	E	1
buttercups (<i>Ranunculus gmelinii/cymbalaria/macounii/sceleratus</i>)	E	1
marsh cinquefoil (<i>Potentilla palustris</i>)	E	1
water hemlock (<i>Cicuta maculata/bulbifera</i>)	E	1
water parsnip (<i>Sium suave</i>)	E	1
rush/western willow asters (<i>Aster borealis/hesperius</i>)	E	T
hedge nettle (<i>Stachys palustris</i>)	E	T
SHRUBS		
willows (<i>Salix pyrifolia/planifolia/exigua/petiolaris/lucida</i>)	E	20
bog birch (<i>Betula glandulosa</i>)	E	10
Labrador tea (<i>Ledum groenlandicum</i>)	L	5
prickly rose (<i>Rosa acicularis</i>)	E	2
TREES		
black spruce (<i>Picea mariana</i>)	L	10
tamarack (<i>Larix laricina</i>)	L	10

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
 † incompatible with conifer regeneration

CLIMATE

- Agrocimate has slight to moderate heat limitations
- The temperature is cooler and moisture is greater than the Black Soil Zone of the Parkland region
- Summer temperatures are warmer than in all other Boreal Subregions; during the winter, only the Central Mixedwood Subregion is colder
- Growing season P-PE = -100 to -200 mm

SECTION 2

SOILS AND LANDSCAPES

- Gleysolic and Organic soils are dominant on poorly drained sites
- profiles generally exceed 65 cm deep
- landscapes are predominantly glaciolacustrine and moraine

SOIL RECLAMATION ISSUES

- the risk of soil erosion by wind is low
- the risk of soil erosion by water is generally low

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slough grass
- fowl bluegrass
- tufted hair grass

(*Beckmannia syzigachne*)
(*Poa palustris*)
(*Deschampsia cespitosa*)

5.2



CENTRAL MIXEDWOOD SUBREGION

After the sun's energy is captured by the green plants, it flows through chains of organisms dendritically, like blood spreading from the arteries into networks of microscopic capillaries. It is in such capillaries, in the life cycles of thousands of individual species, that life's important work is done.

Howard T. Odum, *Environment, Power, and Society* (1971),

5.2.1

SUBXERIC - SUBMESIC SITES (SANDY)**COMMUNITY NAME:** jack pine forest - aspen/whortle berry/grassy slopes**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
blunt/hay sedge (<i>Carex obtusata/siccata</i>)	E	7	three-toothed cinquefoil (<i>Potentilla tridentata</i>)	E	1
northern rice grass (<i>Oryzopsis pungens</i>)	E	5	prairie cinquefoil (<i>Potentilla pennsylvanica</i>)	E	T
Rocky Mountain fescue (<i>Festuca saximontana</i>)	E	3	ascending purple/purple milk vetches (<i>Astragalus striatus/dasyglottis</i>)	E	T
hairy wild rye (<i>Elymus innovatus</i>)	L	2	northern sweet vetch (<i>Hedysarum boreale</i>)	E	T
june grass (<i>Koeleria macrantha</i>)	E	2	showy loco-weed (<i>Oxytropis splendens</i>)	E	T
plains bluegrass (<i>Poa arida</i>)	E	1	horseweed (<i>Erigeron canadensis</i>)	E	T
purple oat grass (<i>Schizachne purpurascens</i>)	E	T	mountain goldenrod (<i>Solidago spathulata</i>)	E	T
plains reed grass (<i>Calamagrostis montanensis</i>)†	E	T	alum-root (<i>Heuchera richardsonii</i>)	L	T
Canada wild rye (<i>Elymus canadensis</i>)	E	T			
FORBS			SHRUBS		
twin-flower (<i>Linnaea borealis</i>)	E	3	low bilberry (<i>Vaccinium myrtillus</i>)	L	9
woodland/wild strawberry (<i>Fragaria vesca/virginiana</i>)	E	2	bearberry (<i>Arctostaphylos uva-ursi</i>)	E	5
bunchberry (<i>Cornus canadensis</i>)	E	2	prickly rose (<i>Rosa acicularis</i>)	E	2
bastard toad flax (<i>Comandra umbellata</i>)	E	2	saskatoon (<i>Amelanchier alnifolia</i>)	E	2
northern wormwood (<i>Artemisia campestris</i>)	E	2	pin cherry (<i>Prunus pennsylvanica</i>)	E	2
lyre-leaved rock cress (<i>Arabis lyrata</i>)	E	1			
cow-wheat (<i>Melampyrum lineare</i>)	E	1	TREES		
			jack pine (<i>Pinus backsiana</i>)	L	40
			trembling aspen (<i>Populus tremuloides</i>)	L	40

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
 † incompatible with conifer regeneration

CLIMATE

- The agroclimate has moderate to severe limitations in the north
- Precipitation between the Dry and Central Mixedwood Subregions is similar; colder temperatures towards the north cause lower moisture deficits in the summer and a longer snowfall cover in the winter
- Growing season P-PE = -100 to -200 mm

SECTION 2

SOILS AND LANDSCAPES

- soils are Eutric Brunisols and Orthic and Dark Gray Luvisols, sandy in texture
- landscapes are predominantly undulating moraine with significant glaciolacustrine blankets over till and fluvial deposits
- soils profiles are 55 cm deep

SOIL RECLAMATION ISSUES

- potential risk of soil erosion by water is generally low
- a high risk of soil erosion by wind occurs on the Lesser Slave Plain or north of Cold Lake
- in forest areas, the salvaged topsoil may include the Ae and all horizons above it

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- june grass
- Canada wild rye
- Rocky Mountain fescue

(*Koeleria macrantha*)
(*Elymus canadensis*)
(*Festuca saximontana*)

5.2.2

MESIC SITES**COMMUNITY NAME:** aspen/rose - low bush cranberry**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
hairy wild rye (<i>Elymus innovatus</i>)	L	10	American vetch (<i>Vicia americana</i>)	L	1
bluejoint (<i>Calamagrostis canadensis</i>)†	L	3	narrow-leaved hawkweed (<i>Hieracium umbellatum</i>)	E	T
purple oat grass (<i>Schizachne purpurascens</i>)	L	1	alpine milk vetch (<i>Astragalus alpinus</i>)	E	T
fringed brome (<i>Bromus ciliatus</i>)	L	1	northern bedstraw (<i>Galium boreale</i>)	E	T
awned wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale</i>)	E	1	common yarrow (<i>Achillea millefolium</i>)	E	T
mountain rice grass (<i>Oryzopsis asperifolia</i>)	E	T	smooth fleabane (<i>Erigeron glabellus</i>)	E	T
spike trisetum (<i>Trisetum spicatum</i>)	E	T	Canada goldenrod (<i>Solidago canadensis</i>)	E	T
tickle grass (<i>Agrostis scabra</i>)	E	T	anemones (<i>Anemone canadensis</i> / <i>multifida</i> / <i>parviflora</i>)	E	T
bluegrasses (<i>Poa interior/glauca/palustris</i>)	E	T	wild lily-of-the-valley (<i>Maianthemum canadense</i>)	E	T
FORBS			SHRUBS		
fireweed (<i>Epilobium angustifolium</i>)	E	6	low-bush cranberry (<i>Viburnum edule</i>)	L	10
bunchberry (<i>Cornus canadensis</i>)	E	6	prickly rose (<i>Rosa acicularis</i>)	L	10
wild sarsaparilla (<i>Aralia nudicaulis</i>)	L	5	green alder (<i>Alnus crispa</i>)	E	6
twin-flower (<i>Linnaea borealis</i>)	E	5	raspberry (<i>Rubus ideaus</i>)	E	5
cream-coloured pea vine (<i>Lathyrus ochroleucus</i>)	E	2	Canada buffalo-berry (<i>Shepherdia canadensis</i>)	E	3
tall lungwort (<i>Mertensia paniculata</i>)	E	2	honeysuckles (<i>Lonicera involucrata/dioica</i>)	E	2
veiny meadow rue (<i>Thalictrum venulosum</i>)	E	2	red osier dogwood (<i>Cornus stolonifera</i>)	E	1
showy/Lindley's asters (<i>Aster conspicuus/ciliolatus</i>)	E	1	TREES		
cow parsnip (<i>Heracleum lanatum</i>)	E	1	trembling aspen (<i>Populus tremuloides</i>)	L	45
Bishop's-cap (<i>Mitella nuda</i>)	E	1	balsam poplar (<i>Populus balsamifera</i>)	E	2
star-flowered Solomon's-seal (<i>Smilacina stellata</i>)	E	1	white spruce (<i>Picea glauca</i>)	E	2

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
 † incompatible with conifer regeneration

CLIMATE

- The agroclimate has moderate to severe limitations in the north
- Precipitation between the Dry and Central Mixedwood Subregions is similar; colder temperatures toward the north cause lower moisture deficits in the summer and a longer snowfall in the winter
- Growing season P-PE = -100 to -150 mm

SOILS AND LANDSCAPES

- soils are predominantly Orthic and Dark Grey Luvisols with depressional and poorly drained areas containing Gleysols and Organics
- landscapes are undulating to hummocky moraines with significant glaciolacustrine blankets over till and fluvial deposits
- profile development can be to 70 cm with 15 cm of topsoil

SOIL RECLAMATION ISSUES

- the risk of soil erosion by water is generally low although hummocky topography has high potential
- the risk of soil erosion by wind is moderate to low
- wet sites may present establishment and fertility problems

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- awned wheat grass
- fowl bluegrass
- spike trisetum
- American vetch

(*Agropyron trachycaulum* var. *unilaterale*)
 (*Poa palustris*)
 (*Trisetum spicatum*)
 (*Vicia americana*)

5.2.3

SUBHYGRIC - HYGRIC SITES

COMMUNITY NAME: black spruce-marsh reed grass - lowland sedge
(combines lowland sedge, reed grass and black spruce community types)

CLIMAX COMMUNITY DESCRIPTION (ungrazed):

**VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
bluejoint (<i>Calamagrostis canadensis</i>)†	E	55	western dock (<i>Rumex occidentalis</i>)	E	1
water sedge (<i>Carex aquatilis</i>)	L	45	dwarf raspberry (<i>Rubus arcticus</i>)	L	1
awned sedge (<i>Carex atherodes</i>)	L	10	grass-of-parnassus (<i>Parnassia palustris</i>)	L	1
beaked sedge (<i>Carex rostrata</i>)	L	10	cloudberry (<i>Rubus chamaemorus</i>)	E	1
manna grasses (<i>Glyceria striata/borealis/grandis</i>)	E	2	balsam groundsel (<i>Senecio pauperculus</i>)	E	T
northern reed grass (<i>Calamagrostis inexpansa</i>)†	L	1	brook ragwort (<i>Senecio triangularis</i>)	E	T
narrow reed grass (<i>Calamagrostis stricta</i>)†	L	1	rush aster (<i>Aster borealis</i>)	E	T
sedges (<i>Carex raymondii/aurea/capillaris</i>)	E	1	hedge nettle (<i>Stachys palustris</i>)	E	T
slough grass (<i>Beckmannia syzigachne</i>)	E	1	field horsetail (<i>Equisetum arvense</i>)	E	T
fowl bluegrass (<i>Poa palustris</i>)	E	T	arrow leaved coltsfoot (<i>Petasites sagittatus</i>)	E	T
tufted hair grass (<i>Deschampsia cespitosa</i>)	E	T			
common reed grass (<i>Phragmites australis</i>)	E	T	SHRUBS		
			Labrador tea (<i>Ledum groenlandicum</i>)	L	10
FORBS			willows (<i>Salix candida/glauca/macalliana</i>)	E	7
wild mint (<i>Mentha arvensis</i>)	E	1	bog cranberry (<i>Vaccinium vitis-idaea</i>)	L	3
marsh skullcap (<i>Scutellaria galericulata</i>)	E	1	currants (<i>Ribes lacustre/hudsonianum</i>)	E	1
northern willow herb (<i>Epilobium ciliatum</i>)	E	1			
			TREES		
			black spruce (<i>Picea mariana</i>)	L	10
			tamarack (<i>Larix laricina</i>)	L	6

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
† incompatible with conifer regeneration

CLIMATE

- Agroclimate has severe heat limitations
- Average precipitation is 460 mm, most of which occurs during the summer, making this subregion the second wettest area in Alberta
- Summer temperatures are colder than the Dry Mixedwood Subregion
- Growing season P-PE = -50 to 0 mm

SOILS AND LANDSCAPES

- soils are dominantly Gleysols with some Organic
- depressional or discharge areas in undulating and hummocky morainal tills

SOIL RECLAMATION ISSUES

- despite high rainfall, risk of water erosion is low to moderate because of long slopes
- the risk of soil erosion by wind is low
- cool or cold soils may inhibit germination and vigor of seedlings

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slough grass
- fowl bluegrass
- tufted hair grass

(*Beckmannia syzigachne*)
 (*Poa palustris*)
 (*Deschampsia cespitosa*)

5.3



BOREAL HIGHLANDS SUBREGION

*Conservation is a state of harmony with a friend; you cannot
cherish his right hand and chop off his left.*

Aldo Leopold

5.3.1

SUBXERIC - SUBMESIC SITES (SANDY)

COMMUNITY NAME: combines jack pine forest, aspen-whortleberry forests and open grassy slopes

CLIMAX COMMUNITY DESCRIPTION (ungrazed):

**VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
blunt sedge (<i>Carex obtusata</i>)	L	7	cow-wheat (<i>Melampyrum lineare</i>)	E	1
northern rice grass (<i>Oryzopsis pungens</i>)	L	5	cream-coloured pea vine (<i>Lathyrus ochroleucus</i>)	E	T
Rocky Mountain fescue (<i>Festuca saximontana</i>)	E	3			
hairy wild rye (<i>Elymus innovatus</i>)	E	2	FORBS		
june grass (<i>Koeleria macrantha</i>)	E	2	American vetch (<i>Vicia americana</i>)	L	T
plains bluegrass (<i>Poa arida</i>)	E	T	showy loco-weed (<i>Oxytropis splendens</i>)	E	T
northern wheat grass (<i>Agropyron dasystachyum</i>)	E	T	Canada/cut-leaved anemone (<i>Anemone canadensis/multifida</i>)	E	T
spike trisetum (<i>Trisetum spicatum</i>)	E	T	Missouri/mountain goldenrods (<i>Solidago missouriensis/ spathulata</i>)	E	T
Canada wild rye (<i>Elymus canadensis</i>)	E	T	prairie cinquefoil (<i>Potentilla pensylvanica</i>)	E	T
fringed brome (<i>Bromus ciliatus</i>)	E	T	horseweed (<i>Erigeron canadensis</i>)	E	T
plains reed grass (<i>Calamagrostis montanensis</i>)†	E	T			
FORBS			SHRUBS		
twin-flower (<i>Linnaea borealis</i>)	E	3	low bilberry (<i>Vaccinium myrtillus</i>)	L	9
northern wormwood (<i>Artemisia campestris</i>)	E	2	bearberry (<i>Arctostaphylos uva-ursi</i>)	E	5
woodland/wild strawberry (<i>Fragaria vesca/virginiana</i>)	E	2	prickly rose (<i>Rosa acicularis</i>)	E	2
bunchberry (<i>Cornus canadensis</i>)	E	2	saskatoon (<i>Amelanchier alnifolia</i>)	E	2
three-toothed cinquefoil (<i>Potentilla tridentata</i>)	E	1	pin cherry (<i>Prunus pensylvanica</i>)	E	2
bastard toad-flax (<i>Comandra umbellata</i>)	E	1			
			TREES		
			jack pine (<i>Pinus banksiana</i>)	L	40
			trembling aspen (<i>Populus tremuloides</i>)	L	40

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
† incompatible with conifer regeneration

CLIMATE

- Agroclimate has very severe to severe heat limitations
- Temperatures are slightly colder and precipitation is slightly higher than the Central Mixedwood Subregion and, as a result, snow cover persists a little longer
- Growing season P-PE = approximately 0 mm

SOILS AND LANDSCAPES

- soils are predominantly Eutric Brunisols
- landforms are composed of undulating to hummocky moraine (till) often over bedrock; submesic-subxeric sites frequently occur on steep slopes at the base of prominent uplands

SOIL RECLAMATION ISSUES

- the risk of soil erosion by water is moderate to high on slopes that are steep or long
- the risk of soil erosion by wind is low

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- june grass
- northern wheat grass
- Rocky Mountain fescue
- spike trisetum
- American vetch

(*Koeleria macrantha*)
 (*Agropyron dasystachyum*)
 (*Festuca saximontana*)
 (*Trisetum spicatum*)
 (*Vicia americana*)

5.3.2

MESIC SITES

COMMUNITY NAME: aspen/alder

CLIMAX COMMUNITY DESCRIPTION (ungrazed):

**VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRSS-LIKE			FORBS <i>continued</i>		
hairy wild rye (<i>Elymus innovatus</i>)	L	15	northern gentian (<i>Gentianella amarella</i>)	E	1
bluejoint (<i>Calamagrostis canadensis</i>)†	L	3	Lindley's/showy asters (<i>Aster ciliolatus/conspicuous</i>)	E	1
awned/slender wheat grass (<i>Agropyron trachycaulum</i> var. <i>unilaterale/trachycaulum</i>)	E	2	common yarrow (<i>Achillea millefolium</i>)	E	T
purple oat grass (<i>Schizachne purpurascens</i>)	E	1	northern bedstraw (<i>Galium boreale</i>)	E	T
mountain rice grass (<i>Oryzopsis asperifolia</i>)	E	1	small wood anemone (<i>Anemone parviflora</i>)	E	T
fringed brome (<i>Bromus ciliatus</i>)	E	T	veiny meadow rue (<i>Thalictrum venulosum</i>)	E	T
spike trisetum (<i>Trisetum spicatum</i>)	E	T	smooth fleabane (<i>Erigeron glabellus</i>)	E	T
northern rough fescue (<i>Festuca altaica</i>)	E	T	narrow-leaved hawkweed (<i>Hieracium umbellatum</i>)	E	T
tickle grass (<i>Agrostis scabra</i>)	E	T	Missouri/mountain goldenrod (<i>Solidago missouriensis/spathulata</i>)	E	T
FORBS			harebell (<i>Campanula rotundifolia</i>)	E	T
bunchberry (<i>Cornus canadensis</i>)	E	5	SHRUBS		
fireweed (<i>Epilobium angustifolium</i>)	E	4	low bush cranberry (<i>Viburnum edule</i>)	E	15
twin-flower (<i>Linnaea borealis</i>)	E	4	green alder (<i>Alnus crispa</i>)	L	9
bishop's-cap (<i>Mitella nuda</i>)	E	2	prickly rose (<i>Rosa acicularis</i>)	E	6
American vetch (<i>Vicia americana</i>)	L	2	red osier dogwood (<i>Cornus stolonifera</i>)	E	2
wintergreens (<i>Pyrola asarifolia/elliptica</i>)	E	1	TREES		
palmate coltsfoot (<i>Petasites palmatus</i>)	E	1	trembling aspen (<i>Populus tremuloides</i>)	L	47
bastard toad-flax (<i>Comandra umbellata</i>)	E	1	balsam poplar (<i>Populus balsamifera</i>)	E	1
lily-of-the-valley (<i>Maianthemum canadense</i>)	E	1	white spruce (<i>Picea glauca</i>)	E	1
cream-coloured pea vine (<i>Lathyrus ochroleucus</i>)	E	1			

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
† incompatible with conifer regeneration

CLIMATE

- Agroclimate has very severe to severe heat limitations
- Temperatures are slightly colder and precipitation is slightly higher than the Central Mixedwood Subregion and, as a result, snow cover persists a little longer
- Growing season P-PE = approximately 0 mm

SOILS AND LANDSCAPES

- soils are generally Luvisolic while Organic Cryosols are also present
- landforms are composed of undulating to hummocky moraine (till) often over bedrock; colluvium material over bedrock often occurs on steep slopes at the base of prominent slopes

SOIL RECLAMATION ISSUES

- the risk of soil erosion by water is high on slopes that are steep or long
- the risk of soil erosion by wind is low
- surface disturbance of Organic Cryosols, causing a loss of insulating cover, will result in flooding as permafrost melts

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slender wheat grass
- awned wheat grass
- spike trisetum
- American vetch

(*Agropyron trachycaulum* var. *trachycaulum*)
 (*Agropyron trachycaulum* var. *unilaterale*)
 (*Trisetum spicatum*)
 (*Vicia americana*)

5.3.3

SUBHYGRIC - HYGRIC SITES**COMMUNITY NAME:** black spruce-reed grass - lowland sedges**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE		
bluejoint (<i>Calamagrostis canadensis</i>)†	L	55
water sedge (<i>Carex aquatilis</i>)	L	45
awned sedge (<i>Carex atherodes</i>)	L	10
beaked sedge (<i>Carex rostrata</i>)	L	10
northern/narrow-leaved reed grasses (<i>Calamagrostis inexpansa/stricta</i>)†	L	2
sedges (<i>Carex brunnescens/curta/lanuginosa</i>)	E	1
slough grass (<i>Beckmannia syzigachne</i>)	E	1
fowl bluegrass (<i>Poa palustris</i>)	E	1
manna grasses (<i>Glyceria borealis/striata/grandis</i>)	E	1
FORBS		
wild mint (<i>Mentha arvensis</i>)	E	1
marsh skullcap (<i>Scutellaria galericulata</i>)	E	1
northern willow herb (<i>Epilobium ciliatum</i>)	E	1
dock (<i>Rumex maritimus/occidentalis triangulivalis</i>)	E	1
purple paint-brush (<i>Castilleja raupii</i>)	E	1

SPECIES	*	% CANOPY COVER
FORBS continued		
rush/western willow asters (<i>Aster borealis/hesperius</i>)	E	1
ladies'-tresses (<i>Spiranthes romanzoffiana</i>)	E	1
marsh/kidney-leaved violets (<i>Viola palustris/renifolia</i>)	E	1
water hemlocks (<i>Cicuta bulbifera/maculata</i>)	E	1
leafy arnica (<i>Arnica chamissonis</i>)	E	T
hedge nettle (<i>Stachys palustris</i>)	E	T
balsam groundsel (<i>Senecio pauperculus</i>)	E	T
SHRUBS		
willows (<i>Salix arbusculoides/pyrifolia/candida/maccalliana/myrtillifolia</i>)	E	20
labrador tea (<i>Ledum groenlandicum</i>)	E	10
prickly rose (<i>Rosa acicularis</i>)	E	2
currants/gooseberry (<i>Ribes triste/hudsonianum/lacustre/oxyacanthoides</i>)	E	1
TREES		
black spruce (<i>Picea mariana</i>)	L	10
tamarack (<i>Larix laricina</i>)	L	10

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
 † incompatible with conifer regeneration

CLIMATE

- Agroclimate has very severe to severe heat limitations
- Temperatures are slightly colder and precipitation is slightly higher than the Central Mixedwood Subregion and, as a result, snow cover persists a little longer
- Growing season P-PE = approximately 0 mm

SECTION 2

SOILS AND LANDSCAPES

- soils are Gleysols or Organics
- landforms are composed of undulating hummocky moraine (till), often over bedrock; colluvium material over bedrock often occurs on steep slopes at the base of prominent uplands

SOIL RECLAMATION ISSUES

- the risk of soil erosion by water is high on slopes that are steep or long
- the risk of soil erosion by wind is low

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slough grass
- fowl bluegrass

(*Beckmannia syzigachne*)
(*Poa palustris*)

5.4



SUBARCTIC SUBREGION

*A land ethic, then, reflects the existence of an ecological conscience,
and this in turn reflects a conviction of individual responsibility
for the health of the land. Health is the capacity of the land
for self-renewal. Conservation is our effort to
understand and preserve this capacity.*

Aldo Leopold, *The Land Ethic*.

5.4.1

MESIC SITES**COMMUNITY NAME:** aspen - spruce/buffalo berry/stair step moss**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
alpine timothy (<i>Phleum commutatum</i>)	E	1	American vetch (<i>Vicia americana</i>)	E	1
spike trisetum (<i>Trisetum spicatum</i>)	E	1	greenish-flowered wintergreen (<i>Pyrola chlorantha</i>)	E	1
northern rice grass (<i>Oryzopsis pungens</i>)	E	1	reflexed loco-weed (<i>Oxytropis deflexa</i>)	E	T
bluegrass (<i>Poa glauca</i>)	E	1	American sweet vetch (<i>Hedysarum alpinum</i>)	E	T
small flowered wood rush (<i>Luzula parviflora</i>)	E	1	common yarrow (<i>Achillea millefolium</i>)	E	T
hairy wild rye (<i>Elymus innovatus</i>)	E	1			
purple reed grass (<i>Calamagrostis purpurascens</i>)†	E	T	SHRUBS		
awned/slender wheat grass (<i>Agropyrontrachycaulum</i> var. <i>unilaterale/trachycaulum</i>)	E	T	Canada buffalo berry (<i>Shepherdia canadensis</i>)	L	5
bluejoint (<i>Calamagrostis canadensis</i>)†	E	T	prickly rose (<i>Rosa acicularis</i>)	E	5
Rocky Mountain fescue (<i>Festuca saximontana</i>)	E	T	cow-berry (<i>Vaccinium vitis-idaea</i>)	E	4
fowl bluegrass (<i>Poa palustris</i>)	E	T	low-bush cranberry (<i>Viburnum edule</i>)	E	2
			beaked willow (<i>Salix bebbiana</i>)	E	2
FORBS					
fireweed (<i>Epilobium angustifolium</i>)	E	1	TREES		
cream-coloured pea vine (<i>Lathyrus ochroleucus</i>)	E	1	trembling aspen (<i>Populus tremuloides</i>)	L	26
one-sided wintergreen (<i>Orthilia secunda</i>)	E	1	white spruce (<i>Picea glauca</i>)	L	5
bastard toad-flax (<i>Comandra umbellata</i>)	E	1			
tall lungwort (<i>Mertensia paniculata</i>)	E	1	MOSSES		
common pink wintergreen (<i>Pyrola asarifolia</i>)	E	1	stair step moss (<i>Hylocomium splendens</i>)	L	13
			LICHENS		
			reindeer lichens (<i>Cladina ssp.</i>)	L	2
			dog lichens (<i>Peltigera ssp.</i>)	L	1

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species % **CANOPY COVER:** T = trace amounts
 † incompatible with conifer regeneration

CLIMATE

- The agroclimate has very, very severe heat limitations
- Temperatures are colder than the Boreal Highlands Subregion and the permafrost does not thaw; temperatures during an arctic high are warmer at higher elevations
- Chinooks do not occur
- Growing season P-PE = less than 150 mm

SOILS AND LANDSCAPES

- soils are Gray Luvisols, Eutric Brunisol, and Luvic Gleysols
- the landscape is composed of shallow, Organic Cryosols over moraine and bedrock

SOIL RECLAMATION ISSUES

- permafrost melt occurs when insulating layers are removed

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)

- slender wheat grass
- awned wheat grass
- fowl bluegrass
- spike trisetum
- Rocky Mountain fescue
- American vetch

(*Agropyron trachycaulum* var. *trachycaulum*)
 (*Agropyron trachycaulum* var. *unilaterale*)
 (*Poa palustris*)
 (*Trisetum spicatum*)
 (*Festuca saximontana*)
 (*Vicia americana*)

5.4.2

SUBHYDRIC - HYDRIC SITES**COMMUNITY NAME:** black spruce - labrador tea - lichen**CLIMAX COMMUNITY DESCRIPTION (ungrazed):****VEGETATION COMMUNITY**

SPECIES	*	% CANOPY COVER	SPECIES	*	% CANOPY COVER
GRASSES/GRASS-LIKE			FORBS <i>continued</i>		
water sedge (<i>Carex aquatilis</i>)	E	2	bedstraw (<i>Galium trifidum/labradoricum</i>)	E	1
reed grasses (<i>Calamagrostis stricta/inexpansa</i>)†	E	1	three-leaved Solomon's-seal (<i>Smilacina trifolia</i>)	E	1
sedges (<i>Carex gynocrates/disperma/curta/brunnescens/tenuiflora/aurea/limosa/paupercula</i>)	E	1	northern willow herb (<i>Epilobium ciliatum</i>)	E	T
tufted hair grass (<i>Deschampsia cespitosa</i>)	E	T	SHRUBS		
slough grass (<i>Beckmannia syzigachne</i>)	E	T	Labrador tea (<i>Ledum plaustre/groenlandicum</i>)	L	10
fowl bluegrass (<i>Poa palustris</i>)	E	T	cow-berry (<i>Vaccinium vitis-idaea</i>)	E	8
tall/northern manna grasses (<i>Glyceria grandis/borealis</i>)	E	T	bog bilberry (<i>Vaccinium uliginosum</i>)	E	1
water/alpine foxtails (<i>Alopecurus aequalis/occidentalis</i>)	E	T	small bog cranberry (<i>Oxycoccus microcarpus</i>)	E	1
FORBS			TREES		
Labrador lousewort (<i>Pedicularis labradorica</i>)	L	2	black spruce (<i>Picea mariana</i>)	L	11
bracted orchid (<i>Habenaria viridis</i>)	E	2	MOSS AND LICHENE		
cloudberry (<i>Rubus chamaemorus</i>)	E	1	reindeer lichens (<i>Cladina ssp.</i>)	L	39
dwarf raspberry (<i>Rubus arcticus</i>)	L	1	Sphagnum moss (<i>Sphagnum ssp.</i>)	L	33
Jacob's-ladder (<i>Polemonium acutiflorum</i>)	E	1			

* **SUCCESSIONAL STAGE:** L = late successional species E = early-mid successional species
 † incompatible with conifer regeneration

% **CANOPY COVER:** T = trace amounts

CLIMATE

- The agroclimate has very severe heat limitations
- Temperatures are colder than the Boreal Highlands Subregion and the permafrost does not thaw; temperatures during an Arctic high are warmer at higher elevations
- Growing season P-PE = less than 150 mm

SECTION 2

SOILS AND LANDSCAPES	SOIL RECLAMATION ISSUES
<ul style="list-style-type: none">• soils are Cryosols, Organics and Gleysols• the landscape is dominated by shallow Organic Cryosols over moraine and bedrock	<ul style="list-style-type: none">• permafrost melt occurs when insulating layers are removed

NATIVE SEED CURRENTLY AVAILABLE IN COMMERCIAL QUANTITY (>100kg)	
<ul style="list-style-type: none">• tufted hair grass• slough grass• fowl bluegrass	<ul style="list-style-type: none">(<i>Deschampsia cespitosa</i>)(<i>Beckmannia syzigachne</i>)(<i>Poa palustris</i>)

References for Vegetation Communities

Further information about specific site types can be found by consulting the following references:

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Labonte, D. And D. Downing. 1995. *Lower Foothills Benchmark Program*. Available from Public Lands Branch, Alberta Agriculture, Food and Rural Development, Rocky Mountain House, Alberta.

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Sundquist, K.M. and M.G. Willoughby. 1994. *Carrying Capacity Guide for the Low Boreal Mixedwood Ecoregion*. Range Management Section, Forest Management Division, Alberta Environmental Protection, Edmonton. 164pp.

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Willoughby, M.G. 1992. *Rangeland Reference Areas: Plant Communities, Ecology and Response to Grazing in Division 2*. Forestry, Lands and Wildlife. Alberta Forest Service. Edmonton, Pub. No.T/268. 42pp.

Willoughby, M.G., Sundquist K.M. and M.J. Alexander. 1995. *Range Plant Community Types and Carrying Capacity for the Montane Subregion*. Forest Management Division, Alberta Environmental Protection. Edmonton, Alta. 248 pp.

Willoughby, M.G. and D. Smith. 1994. *Range Plant Community Types and Carrying Capacity for the Upper Foothills Subregion*. Forest Management Division, Alberta Environmental Protection. 125pp.

SECTION 3

native plant species characteristics



GERALD HAEKEL



LEGEND

Scientific Name

Common Name

Species in this section include all plants listed in the manual and several additional native species well suited for reclamation projects. Scientific names are restricted to those found in Moss 1983. Frequently encountered synonyms, or closely related species follow a “/”.

Common names were taken from Moss 1983, or Looman & Best 1979.

PBA

All plants are identified as P-perennial, B-biennial, or A-annual. Where some plants may have more than one growth habit, the most frequently encountered habit is listed first.

Growth Form

Height: range in metres

Form: erect, trailing, climbing

Growth: solitary, bunch (tufted), mat, sod, thicket

Alternative growth forms are separated by a comma. (e.g., bunch, mat)

Most commonly encountered forms precede a slash. (e.g., solitary/bunch)

Transitional forms are identified by a dash. (e.g., erect-trailing)

Reproduction

seeds, rhizomes, stolons, tillers.

Most dominant form of reproduction precedes a slash. Alternative reproduction methods are separated by a comma. (e.g., rhizomes/seeds, tillers = reproduces primarily by rhizomes, and to a lesser extent by seeds and tillers).

Plants exhibiting particularly aggressive growth are identified as “aggressive”.

Seed Information

Recommended Seed Pretreatment: scarify, stratify, no treatment. (consult Currah et al. 1983, or Hardy B.B.T. 1989 for more specific methods).

Number of Seeds per Gram

Ecology/Physiology

Seral Stage: early, late

(Some plants are found in both early and late seral stages. This may be a result of broad habitat requirements,

or that the plant is found in early seral stages of one plant community and in the later seral stages of another).

Growing Season: cool, warm

Symbiotic Association: actively mycorrhizal, specific insect associations (i.e., pollinators), parasitic on other plants, nitrogen fixation, allelopathic.

Forage Value

Forage value is rated as toxic, poor, fair, good, or excellent for livestock "L" and wildlife "W". While it should be appreciated that the forage value of plants will vary among seasons and different classes of livestock or wildlife, this generalized rating identifies the relative palatability, nutritive quality, and availability/accessibility of the plant to grazing animals. It should also be noted that for the purposes of this section "wildlife" refers to ungulate wildlife only.

Grazing Response

In response to grazing pressure, plants increase or decrease in abundance. Generally, the most palatable plants are the first to decline, but the ability of the plant to recover through vegetative regrowth or reproduction is also an important factor. Palatability is relative to the available browse/forage. Some plants will be readily grazed on poorer ranges and thus decrease in abundance, while increasing on ranges where other plants are the preferred forage. Plants that establish and grow aggressively on depleted rangelands are called invaders. Depending on the plant community composition of the rangeland, season, and grazing intensity, plants may respond in more than one way to grazing pressure.

Habitat

Soil Texture

The preferred soil texture for each plant is identified as either fine, medium or coarse. A range in soil textures is presented for plants with a broader tolerance.

Soil Moisture

The preferred soil moisture for each plant is identified as either wet, mesic, or dry. A range in soil moistures is presented for plants with a broader tolerance.

Soil Tolerance

Plants that can tolerate prolonged periods of drought or flooding, or can successfully grow on soils that are moderately to highly acidic, alkaline, or saline are identified in this column.

Notes

This includes a more specific description of habitat types and regions within Alberta where the plant may be found. Habitat descriptions were taken predominantly from Moss 1983, and Looman & Best 1979 to maintain consistency among the plants.

Distribution

Plants are identified as either common, locally common, scattered, or rare for the respective habitat types and regions within Alberta described under "Notes".

Natural Region

The numbers presented correspond to the Alberta Natural Regions - Subregions in this manual where the plant has been listed. They may not reflect the plant's full distribution within Alberta.

- | | | |
|--|---|-------------------------------|
| 1. Dry Mixed Grass and Mixed Grass Subregion | } | GRASSLAND NATURAL REGION |
| 2. Foothills Fescue Subregion | | |
| 3. Northern Fescue Subregion | | |
| 4. Central Parkland Subregion | } | PARKLAND NATURAL REGION |
| 5. Foothills Parkland Subregion | | |
| 6. Peace River Parkland Subregion | | |
| 7. Montane Subregion | } | ROCKY MOUNTAIN NATURAL REGION |
| 8. Subalpine Subregion | | |
| 9. Alpine Subregion | | |
| 10. Lower Foothills Subregion | } | FOOTHILLS NATURAL REGION |
| 11. Upper Foothills Subregion | | |
| 12. Dry Mixedwood Subregion | } | BOREAL FOREST NATURAL REGION |
| 13. Central Mixedwood Subregion | | |
| 14. Boreal Highlands Subregion | | |
| 15. Subarctic Subregion | | |

Cultivar/Ecovar

Cultivars available in the prairie provinces and Montana are presented. Consult seed suppliers for more information on specific varieties. Ecovars currently in development are also identified. While these ecovar varieties are not yet available, they are presented here to show the direction of current research.

Seed/Plant Availability

The numbers presented correspond to the supplier list in Appendix B where the respective seed or plants are available. Supplier information is based on the 1995 Alberta Native Plant Council Source List. For more information contact the ANPC at Garneau P.O. Box 52099, Edmonton AB T6G 2T5.

NOTE: Blank columns/cells indicate the respective information was unavailable from the references consulted.

GRASSES AND GRASS-LIKE PLANTS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Agropyron dasystachyum</i> northern wheat grass	P	(0.4-1.3m) erect bunch, sod	rhizomes/seeds, tillers	340 seeds/g	early, late cool	W-good L-good	increaser/ decreaser	
<i>Agropyron smithii/Pascopyrum smithii</i> western wheat grass	P	(0.3-0.6m) erect bunch, sod	rhizomes/seeds, tillers	240 seeds/g	early, late cool	W-fair L-good	increaser/ decreaser	
<i>Agropyron spicatum</i> bluebunch wheat grass	P	(0.3-1.0m) erect bunch	seeds, tillers	310 seeds/g	early cool	W-good L-excellent	decreaser	
<i>Agropyron trachycaulum</i> var. <i>trachycaulum/unilaterale</i> slender/awned wheat grass	P	(0.5-1.5m) erect bunch	rhizomes/seeds, tillers	350/260 seeds/g	late cool	W-good L-excellent	increaser/ decreaser	
<i>Agropyron violaceum</i> alpine wheat grass	P	(0.2-0.5m) erect bunch	rhizomes/seeds, tillers		early	L-excellent	decreaser	
<i>Agrostis scabra</i> tickle grass	P	(0.3-0.7m) erect bunch	seeds, tillers		early cool	L-fair	increaser/ decreaser/ invader	
<i>Alopecurus aequalis</i> water foxtail	P	(0.2-0.5m) erect-trailing solitary, bunch	stolons/seeds, tillers		early, late	L-fair	increaser	
<i>Alopecurus occidentalis</i> alpine foxtail	P	(0.1-0.8m) erect-trailing solitary, bunch	rhizomes/seeds, tillers	1135 seeds/g	early	L-fair	increaser	
<i>Beckmannia syzigachne</i> slough grass	A	(0.3-1.0m) erect-trailing bunch, sod	seeds, tillers	1603-2530 seeds/g	early, late cool	W-good L-fair	increaser	
<i>Bouteloua gracilis</i> blue grama grass	P	(0.1-0.4m) erect bunch, sod	tillers/seeds, rhizomes	1820 seeds/g	late warm	W-good L-good	increaser	
<i>Bromus anomalus</i> nodding brome	P	(0.3-0.6m) erect solitary, bunch	seeds	255 seeds/g	early	L-good	increaser/ decreaser	
<i>Bromus carinatus/marginatus</i> mountain brome	P	(0.6-1.2m) erect bunch	seeds, tillers	95-280 seeds/g	early cool	W-good L-excellent	decreaser	
<i>Bromus ciliatus</i> fringed brome	P	(0.6-1.0m) erect bunch	seeds	306 seeds/g	early, late cool	W-excellent L-excellent	decreaser	
<i>Bromus pumpellianus</i> northern awnless brome	P	(0.2-1.5m) erect bunch, sod	seeds, tillers/ rhizomes	280 seeds/g	early cool	W-good L-good	increaser/ decreaser	
<i>Calamagrostis canadensis</i> bluejoint	P	(0.6-1.2m) erect bunch, sod	rhizomes/seeds aggressive	no treatment 5000 seeds/g	early, late cool	W-fair L-fair	increaser/ decreaser	
<i>Calamagrostis inexpansa</i> northern reed grass	P	(0.4-1.0m) erect solitary, bunch	rhizomes/seeds, tillers		late cool	L-fair	increaser/ decreaser	
<i>Calamagrostis montanensis</i> plains reed grass	P	(0.2-0.4m) erect solitary, bunch	rhizomes/seeds, tillers		early, late cool	L-fair	increaser	

GRASSES AND GRASS-LIKE PLANTS

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
	med. to coarse	mesic to dry	drought, saline, alkaline, flood	prairie grasslands, sand hills, dry open woodlands, prairies and parklands, excellent erosion control	common	1,2,3,4,6,7,10,12,14	cultivar	4,16,20,27,30,32,33,34
	fine to med.	wet to mesic	alkaline, drought, saline, flood	moist grasslands, alkaline river flats, prairies and parklands, excellent erosion control	common	1,3,4,6,7	cultivar, ecovar	4,16,20,27,32,33,34
	med.	mesic to dry	drought, alkaline	dry prairies, southwest Alberta, excellent erosion control	common	2,7	cultivar	4,13,16,20
	med.	mesic to dry	drought, flood, saline, alkaline	A. trach. unil. - open woods, parklands A. trach. trach. - mixed grass prairie, excellent erosion control	common	2,3,4,6,7,12	cultivar, ecovar	4,11,16,20,27,30,31,32,33
				montane and alpine meadows, Rocky Mountains, southwest Alberta		9	cultivar	
	fine to coarse	mesic to dry	drought, acidic	disturbed areas and open woods to subalpine elevations, throughout Alberta, excellent erosion control	common	10,11,13,14		4,20,28,32
		wet	flood	shallow water, muddy shores, river flats, throughout Alberta	common	3,4,15		
				shores and open woodlands, southern Rocky Mountains	rare	10,15		
	med.	wet	alkaline, flood	wet areas, slough margins, lakeshores, throughout Alberta	common	3,4,10,12,13,14,15	cultivar	11,16,28,31
	fine to coarse	dry	drought	dry prairie grasslands, prairies and parklands	common	1,3,4	cultivar, ecovar	4,13,16,20,26,31,32,33
		wet to mesic		moist prairie grasslands, open woods		5,10,12		11,16,30
	fine to med.	wet to mesic		open woods and meadows, southern Rocky Mountains		5,7,8,11	cultivar	4,11,16,30,32
		mesic		open woods and meadows, throughout Alberta	locally common	4,5,7,8,10,11,12,13,14	cultivar	11,16,30
	fine to med.	mesic to dry	drought, saline, alkaline, acidic	open woods and grasslands, to subalpine elevations, roadsides, fields, and waste areas, excellent erosion control	common	2,5,7,8,11	cultivar	11
	fine to coarse	wet to mesic	acidic, flood, drought, saline	marshes and moist woodlands, throughout Alberta, good erosion control	common	4,5,7,8,10,11,12,13,14,15	cultivar	
		wet to mesic	flood	marshy places, low meadows, around sloughs and lakeshores	common	3,4,10,12,13,14,15		
		mesic to dry		moist to moderately dry grasslands, open pine woods, throughout prairies and parklands		1,2,3,4,6,7,10,13,14		

GRASSES AND GRASS-LIKE PLANTS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Calamagrostis purpurascens</i> purple reed grass	P	(0.3-0.7m) erect bunch	rhizomes/seeds, tillers		early cool	L-poor	decreaser	
<i>Calamagrostis rubescens</i> pine grass	P	(0.6-0.9m) erect bunch, solitary	rhizomes/seeds	no treatment	late cool	W-poor L-fair	increaser/ decreaser	
<i>Calamagrostis stricta</i> narrow-leaved reed grass	P	(0.3-0.6m) erect bunch	rhizomes/seeds, tillers		late cool			
<i>Calamovilfa longifolia</i> sand grass	P	(0.8-1.2m) erect solitary, sod	rhizomes/seeds	600 seeds/g	late warm	W-fair L-fair	increaser/ decreaser	
<i>Carex albo-nigra</i>	P	(0.1-0.3m) erect bunch	rhizomes/seeds		early			
<i>Carex aquatilis</i> water sedge	P	(0.2-0.8m) erect bunch, sod	rhizomes/seeds	1070 seeds/g	early, late cool	L-poor	increaser/ decreaser	
<i>Carex atherodes</i> awned sedge	P	(0.3-1.2m) erect bunch	rhizomes/seeds		late	L-excellent	decreaser	
<i>Carex atosquama</i> sedge	P	(0.2-0.5m) erect bunch	rhizomes/seeds		late			
<i>Carex aurea</i> golden sedge	P	(0.1-0.2m) erect bunch	rhizomes, stolons/seeds		early		increaser	
<i>Carex brevior</i> straw-coloured sedge	P	(0.3-1.0m) erect bunch	rhizomes/seeds					
<i>Carex brunnescens</i> brownish sedge	P	(0.1-0.4m) erect bunch	seeds		early			
<i>Carex capillaris</i> hair-like sedge	P	(0.2-0.6m) erect bunch	seeds		early			
<i>Carex concinna</i> beautiful sedge	P	(0.05-0.2m) erect bunch	rhizomes/seeds					
<i>Carex concinnoides</i> low northern sedge	P	(0.15-0.35m) erect bunch	rhizomes/seeds					
<i>Carex curta</i> short sedge	P	(0.2-0.6m) erect bunch	rhizomes/seeds		early			
<i>Carex deweyana</i> Dewey's sedge	P	(0.2-0.8m) erect bunch	rhizomes/seeds					
<i>Carex disperma</i> two-seeded sedge	P	(0.1-0.6m) erect bunch, sod	rhizomes, stolons/seeds		early			

GRASSES AND GRASS-LIKE PLANTS

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
	coarse	dry	drought, alkaline	open slopes, woodlands, Rocky Mountains and Cypress Hills, excellent erosion control		2,7,8,9,15		
	med. to coarse	mesic to dry	drought	open pine woods and banks, Boreal forests, Cypress Hills, southern Rocky Mountains	common	7		
		wet to mesic		wet meadows, banks and shores		3,4,10,12, 13,14,15		
	med. to coarse	mesic to dry	drought, alkaline	sandy prairies, open woods, sand-dunes, prairies and parklands, excellent erosion control	common	1,3,4	cultivar, ecovar	4,20,32,33
				exposed alpine tundra, Rocky Mountains		9		
	fine	wet	alkaline, flood	slough margins, marshes, wet meadows, throughout Alberta	common	3,4,8,10, 11,12,13, 14,15		5,28
	fine to med.	wet	drought, alkaline	slough margins, marshes, wet meadows, throughout Alberta, excellent erosion control	common	3,4,8,10, 11,12,13, 14		28
				subalpine meadows, Rocky Mountains		5,8,11		
		wet to mesic		moist banks and meadows, throughout parklands, Cypress Hills, Boreal forest, and Rocky Mountains		10,11,13, 15		
		wet to mesic		moist meadows, grasslands, open forests, parklands and Boreal forests				
		wet		bogs, muskegs, wet woods, Boreal forests		14,15		
		wet		spring areas, marshes and bogs, Boreal forests		10,11,13		
		wet to mesic		damp woods, meadows, riverbanks, Boreal forests, and Rocky Mountains				
				dry woods, stony riverbanks, southern Rocky Mountains				
		wet		muskeg, bogs and marshes throughout Boreal forests		14,15		
		wet to mesic		moist shady woods, margins of woods and meadows, Boreal forests				
		wet to mesic		damp woods and marshes, bogs, throughout Alberta		15		

GRASSES AND GRASS-LIKE PLANTS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Carex douglasii</i> Douglas sedge	P	(0.1-0.3m) erect solitary, bunch	rhizomes/seeds		early, late			
<i>Carex filifolia</i> thread-leaved sedge	P	(0.08-0.3m) erect bunch	seeds/rhizomes, tillers		late cool	W-excellent L-good	increaser/ decreaser	
<i>Carex gynocrates</i> northern bog sedge	P	(0.04-0.3m) erect solitary	rhizomes/seeds		early			
<i>Carex hoodii</i> Hood's sedge	P	(0.25-0.8m) erect bunch	rhizomes/seeds		late			
<i>Carex lanuginosa</i> woolly sedge	P	(0.3-0.7m) erect bunch	rhizomes/seeds		early, late			
<i>Carex lasiocarpa</i> hairy-fruited sedge	P	(0.4-1.0m) erect bunch	rhizomes/seeds		early			
<i>Carex limosa</i> mud sedge	P	(0.2-0.4m) erect solitary, bunch	rhizomes/seeds		early			
<i>Carex macloviana</i> thick-spike sedge	P	(0.1-0.5m) erect bunch	rhizomes/seeds		late			
<i>Carex microglochin</i> short-awned sedge	P	(0.08-0.25m) erect bunch	rhizomes/seeds		early			
<i>Carex microptera</i> thick-spike sedge	P	(0.2-1.0m) erect bunch	rhizomes/seeds		late			
<i>Carex nardina</i> fragrant sedge	P	(0.3-1.0m) erect bunch	seeds		early			
<i>Carex obtusata</i> blunt sedge	P	(0.06-0.15m) erect bunch	rhizomes/seeds		early, late	L-good	increaser	
<i>Carex paupercula</i> bog sedge	P	(0.2-0.4m) erect solitary, bunch	rhizomes/seeds		early			
<i>Carex pensylvanica</i> sun-loving sedge	P	(0.05-0.3m) erect bunch	rhizomes/seeds		early, late	L-good		
<i>Carex platylepis</i> pasture sedge	P	(0.4-0.7m) erect bunch	rhizomes/seeds		late			
<i>Carex podocarpa</i> alpine sedge	P	(0.1-0.5m) erect bunch	rhizomes/seeds		early			
<i>Carex praticola</i> pasture sedge	P	(0.2-0.6m) erect bunch	rhizomes/seeds		late			

GRASSES AND GRASS-LIKE PLANTS

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
		dry	alkaline	dry grasslands, sandhills, prairies and parklands		1		
	fine to coarse	dry		dry plains and ridges, prairies and parklands, excellent erosion control	common	1		
		wet		sphagnum bogs, marshy places, Boreal forest		15		
		mesic to dry		dry to moist open slopes and meadows, Rocky Mountains		7		
		wet to mesic		slough margins, marshes, throughout Alberta		3,4,14		5
		wet to mesic		bogs, lakeshores and river banks, Boreal forest		12		
		wet		bogs and marshes, Boreal forests	scattered	15		
		wet to mesic		moist grassy slopes		5		
		wet to mesic		peaty marshes, often calcareous, alpine meadows, Rocky Mountains	locally common	9		
		wet to mesic		moist woods, throughout Alberta		5		5
		mesic to dry		dry alpine slopes, rocky areas, Rocky Mountains	scattered	9		
		mesic to dry		dry to moist grasslands, prairies and parklands	locally common	1,2,3,4,6,7,10,13,14		
		wet		bogs and muskegs, Boreal forest		15		
		mesic to dry		dry sandy prairie, open woods and thickets, parklands and Boreal forest	locally common	1,2,3,4,7,8,10,11		
		mesic to dry		meadows, dry open coniferous woods and clearings, parklands and Boreal forests		7		
				alpine meadows, riverbanks, Rocky Mountains		9		
		mesic to dry		open woods and grasslands, parklands and Boreal forest		11		

GRASSES AND GRASS-LIKE PLANTS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Carex praegracilis</i> graceful sedge	P	(0.2-0.7m) erect solitary, bunch	rhizomes/seeds		early			
<i>Carex raymondii</i>	P	(0.3-0.7m) erect bunch	rhizomes/seeds		early, late			
<i>Carex rossii</i> Ross' sedge	P	(0.05-0.3m) erect bunch	rhizomes/seeds		late	L-good		
<i>Carex rostrata</i> beaked sedge	P	(0.5-1.0m) erect bunch, sod	rhizomes/seeds	700 seeds/g	late cool	L-good	decreaser	
<i>Carex scirpoidea</i> rush-like sedge	P	(0.1-0.4m) erect solitary	rhizomes/seeds		late			
<i>Carex siccata</i> hay sedge	P	(0.2-0.8m) erect solitary	rhizomes/seeds		early			
<i>Carex sprengei</i> Sprengel's sedge	P	(0.3-0.8m) erect bunch	rhizomes/seeds		late			
<i>Carex stenophylla</i> dryland sedge	P	(0.03-0.2m) erect bunch, solitary	rhizomes/seeds		early, late	L-fair	increaser	
<i>Carex tenuiflora</i> thin-flowered sedge	P	(0.2-0.6m) erect bunch	rhizomes/seeds		early			
<i>Carex vaginata</i> sheathed sedge	P	(0.1-0.6m) erect solitary, bunch	rhizomes/seeds		early			
<i>Cinna latifolia</i> drooping wood reed	P	(0.6-1.2m) erect solitary-bunch	seeds					
<i>Cyperus schweinitzii</i> sand nut-grass	P	(0.1-0.7m) erect solitary	rhizomes/seeds		early cool			
<i>Danthonia californica</i> California oat grass	P	(0.3-0.9m) erect bunch	seeds, tillers		early, late cool	W-excellent L-excellent		
<i>Danthonia intermedia</i> timber oat grass	P	(0.3-0.5m) erect bunch	seeds, tillers		cool	W-good L-good	increaser/ decreaser	
<i>Danthonia parryi</i> Parry oat grass	P	(0.3-0.6m) erect bunch	seeds, tillers	222 seeds/g	early, late cool	W-good L-good	increaser	
<i>Danthonia spicata</i> poverty oat grass	P	(0.2-0.7m) erect bunch	seeds, tillers		cool	L-fair		
<i>Deschampsia cespitosa</i> tufted hair grass	P	(0.2-1.2m) erect bunch	seeds	5510 seeds/g	early, late cool	W-fair L-good	increaser/ decreaser	

GRASSES AND GRASS-LIKE PLANTS

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
		wet to mesic		marshes, around sloughs, wet meadows, parklands and Boreal forests		3,4		
		wet to mesic		moist places, shady woodlands, meadows throughout Boreal forests		8,5,10,11, 13		
	fine to med.	dry	drought, acidic	dry soils in open woodlands, rocky areas and clearings, throughout prairies, parklands, R. Mountains, Boreal forests	common	7		
		wet to mesic		swamps, marshes, lake shores, river banks, parklands and Boreal forests	common	3,4,8,10, 11,12,13, 14		28
		wet		marshy areas, slopes and meadows, to alpine elevations, throughout Alberta		11		
	coarse	dry		dry sandy areas, open pine woods, Boreal forests		12,13		
		wet to mesic		moist open woods, shrubbery, and meadows, throughout Alberta		2		
		dry		dry grasslands, prairies	locally common	1,2,3,4, 7,10		
		wet		wet woods, bogs and muskegs, Boreal forests	locally common	15		
		wet		wet woods, bogs and muskegs, Boreal forests		10,11		
		wet to mesic		moist woods throughout Boreal forests				
	med. to coarse	dry	drought	rather dry sandy soil, south and eastern grasslands, potentially good erosion control	rare	3,4		
		dry		dry to moist open areas and open woods to subalpine elevations, prairies, southern Rocky Mountains	rare	5,7,8,10		
	fine to med.	mesic to dry		fescue grasslands, parklands, Boreal forests, Cypress Hills	common	4		
	coarse	dry		prairies, southern Rocky Mountains	locally common	2,5,8,10		16
		mesic to dry		dry to moist open areas and open woods, prairies, Rocky Mountains, parklands, and Boreal forests	rare			
	fine to med.	wet to mesic	saline, alkaline, acidic	moist rich soils in open areas, throughout Alberta, excellent erosion control	common	8,10,11, 12,13,15	cultivar	4,20,30,32,33

GRASSES AND GRASS-LIKE PLANTS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Distichlis stricta</i> salt grass	P	(0.1-0.4m) erect-trailing bunch, sod	rhizomes/seeds	1150 seeds/g	late warm	W-poor L-poor/toxic	increaser	
<i>Eleocharis palustris</i> creeping spike rush	P	(0.1-1.0m) erect bunch	rhizomes/seeds		early	L-poor		
<i>Elymus canadensis</i> Canadian wild rye	P	(0.7-1.2m) erect bunch	seeds, tillers	156-250 seeds/g	early cool	W-good L-good	decreaser	
<i>Elymus glaucus</i> smooth wild rye	P	(0.4-1.0m) erect bunch	seeds, tillers	240 seeds/g	cool			
<i>Elymus innovatus</i> hairy wild rye	P	(0.4-1.0m) erect bunch, sod	rhizomes/seeds	392 seeds/g	early, late	L-poor	increaser/ decreaser	
<i>Elymus piperi/cinereus</i> giant wild rye	P	(2.0-3.0m) erect bunch	seeds, tillers, rhizomes	290 seeds/g	cool	W-fair L-fair	decreaser	
<i>Eriophorum brachyantherum</i> close-sheathed cotton grass	P	(0.3-0.6m) erect bunch	seeds					
<i>Eriophorum vaginatum</i> sheathed cotton grass	P	(0.2-0.6m) erect bunch	seeds		early			
<i>Festuca altaica</i> northern rough fescue	P	(0.3-0.9m) erect bunch	seeds, tillers/ rhizomes		early, late cool	W-good L-excellent	decreaser	
<i>Festuca baffinensis</i> alpine fescue	P	(0.05-0.2m) erect bunch	seeds		early cool			
<i>Festuca brachyphylla</i> alpine fescue	P	(0.05-0.2m) erect bunch	seeds		early cool	L-fair		
<i>Festuca campestris</i> rough fescue (from Looman 1983)	P	(0.3-0.8m) erect solitary, bunch	seeds	440-664 seeds/g	late cool	W-excellent L-excellent	decreaser	
<i>Festuca hallii</i> plains rough fescue (from Looman & Best 1979)	P	(0.2-0.6m) erect bunch	rhizomes/seeds	445 seeds/g	early, late cool	W-good L-good	decreaser	
<i>Festuca idahoensis</i> Idaho fescue	P	(0.3-0.8m) erect bunch	seeds, tillers	990 seeds/g	early, late cool	W-excellent L-excellent	increaser	
<i>Festuca ovina</i> sheep fescue Introduced Elements	P	(0.15-0.6m) erect bunch	seeds, tillers	1500 seeds/g	cool N fixation	W-good L-good	increaser/ decreaser	
<i>Festuca saximontana</i> rocky mountain fescue	P	(0.1-0.5m) erect bunch	seeds, tillers	1498 seeds/g	early cool	L-excellent	increaser	
<i>Glyceria borealis</i> northern manna grass	P	(0.5-1.0m) erect solitary, bunch	rhizomes/seeds		early	L-good	decreaser	

GRASSES AND GRASS-LIKE PLANTS

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
	fine to med.	wet to mesic	saline, alkaline, drought	saline prairies, salt marshes, dry saline areas, prairies and parklands, excellent erosion control	locally common	1,3,4		
		wet		shallow water, mud flats, lake shores, throughout Alberta	common	3,4		5
	med. to coarse	mesic to dry	alkaline	river banks, sandy areas, prairies and parklands	locally common	1,3,4,13, 14	cultivar, ecovar	13,26,31
	med. to coarse	mesic to dry	alkaline	moist to dry open woods and hillsides, parklands	scattered	7,10		11,30
	fine to coarse	mesic to dry		open pine woodlands, Boreal forests, excellent erosion control	common	5,7,8,10, 11,12,13, 14,15		
	fine to coarse	mesic	saline, alkaline, drought, flood	riverbanks, ravines, moist slopes, southern prairies	locally common		cultivar	11,13,34
		wet		bogs and swamps, Boreal forests		10		
		wet		dry peat bogs and marshes, Boreal forests		10		
	fine to med.	dry		dry grasslands, open woods, northern Rocky Mountains	rare	9,11,14		
		dry		dry alpine slopes		9		
				alpine slopes		9		
				dry grasslands, forest openings, in foothills and Rocky Mountains		2,5,7,8,9, 10,11	cultivar, ecovar	4,11,16,20
		mesic to dry		parklands prairie, Cypress Hills	scattered	3,4	ecovar	16,26
	fine to med.	mesic to dry	alkaline, drought	prairie grasslands, fescue prairie, Cypress Hills, southern R. Mountains	common	2,5,7,8,	cultivar, ecovar	4,16,33
	fine to coarse	mesic to dry	drought, acidic	grasslands and open woods, prairies and parklands, Boreal forests, excellent erosion control	scattered	3,4	cultivar	
		dry		grasslands and open woods, prairies and parklands, Boreal forests		3,4,5,6,7, 9,12,13, 14,15	cultivar, ecovar	
	fine	wet	flood	slough margins, lake shores, shallow water, wet meadows, Boreal forests	common	10,12,13, 14,15		

GRASSES AND GRASS-LIKE PLANTS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Glyceria grandis</i> tall manna grass	P	(1.0-1.5m) erect solitary-sod	rhizomes/seeds		early, late	L-excellent	decreaser	
<i>Glyceria striata</i> fowl manna grass	P	(0.3-0.8m) erect bunch	rhizomes		early	L-good	decreaser	
<i>Helictotrichon hookeri</i> Hooker's oat grass	P	(0.2-0.4m) erect solitary, bunch	seeds, tillers		early, late cool	W-fair L-fair	increaser/ decreaser	
<i>Hierochloa alpina</i> holy grass	P	(0.1-0.4m) erect bunch, sod	rhizomes/seeds		early	L-poor	decreaser	
<i>Hierochloa odorata</i> sweet grass	P	(0.3-0.6m) erect solitary	rhizomes/seeds		early, late	L-fair	increaser/ decreaser	
<i>Hordeum jubatum</i> foxtail barley	P	(0.3-1.0m) erect-trailing bunch	seeds, tillers		early, late cool	W-good L-poor	invader/ increaser	
<i>Juncus balticus</i> baltic rush	P	(0.2-0.6m) erect solitary	rhizomes/seeds		early, late	L-poor	increaser	
<i>Juncus drummondii</i> Drummond's rush	P	(0.1-0.3m) erect bunch	seeds		late			
<i>Juncus mertensianus</i> slender-stemmed rush	P	(0.1-0.4m) erect bunch	rhizomes/seeds		late			
<i>Koeleria macrantha/cristata</i> june grass	P	(0.2-0.5m) erect bunch	seeds, tillers	scarify 5100 seeds/g	early, late cool	W-good L-good	increaser	
<i>Luzula parviflora</i> small-flowered wood rush	P	(0.3-0.6m) erect solitary, bunch	rhizomes/seeds		early, late	L-excellent	decreaser	
<i>Luzula spicata</i> spiked woodrush	P	(0.1-0.3m) erect bunch	seeds		late			
<i>Oryzopsis asperifolia</i> white-grained mountain rice grass	P	(0.2-0.7m) erect bunch	seeds, tillers		early, late cool	L-good	increaser/ decreaser	
<i>Oryzopsis hymenoides</i> indian rice grass	P	(0.3-0.7m) erect bunch	seeds, tillers	scarify & stratify 310 seeds/g	late cool	W-excellent L-excellent	decreaser	
<i>Oryzopsis pungens</i> northern rice grass	P	(0.2-0.5m) erect bunch	seeds, tillers		late cool	L-fair	decreaser	
<i>Phalaris arundinacea</i> reed canary grass <i>Introduced Elements</i>	P	(0.6-1.5m) erect bunch, sod	rhizomes/seeds	1170 seeds/g	cool	W-fair L-fair	increaser/ decreaser/ invader	
<i>Pheum commutatum/alpinum</i> alpine timothy	P	(0.1-0.5m) erect-trailing solitary, bunch	seeds, tillers		early cool	W-excellent L-excellent	decreaser	

GRASSES AND GRASS-LIKE PLANTS

HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
fine	wet	flood	slough margins, lake shores, riverbanks throughout Alberta	common	3,4,10, 12,13, 14,15		5
fine	wet	flood	shallow water, boggy meadows, throughout Alberta	common	10,13,14		
fine to coarse	mesic		moist to moderately dry prairies, prairies, parklands, Rocky Mountains, Cypress Hills	common	1,2,3,4, 8,10		
coarse	mesic to dry	saline	dry alpine slopes and arctic meadows, Boreal forests, Rocky Mountains, excellent erosion control	rare	9		
	mesic to dry	drought, saline, alkaline	moist grasslands, open woods, throughout Alberta, excellent erosion control; considered weedy in agricultural settings		1,2,3,4,5, 8,9,10,11		11,31
fine to coarse	wet to dry	saline, alkaline, drought, flood	fields, waste areas, roadsides, saline marshes, throughout Alberta, excellent erosion control	common	1,3,4		
fine to coarse	wet	flood	wet meadows, slough margins, lake shores, throughout Alberta, excellent erosion control	common	3,4,12		5
	wet to mesic	flood	moist montane slopes, Rocky Mountains		9		
	wet	flood	wet ground, meadows and slopes, Rocky Mountains, Cypress Hills	rare	9		
med. to coarse	mesic to dry	drought, alkaline	grasslands and forest openings, light calcareous soils, throughout Alberta, good erosion control	common	1,2,3,4,6, 7,8,10,11, 12,13,14	cultivar, ecovar	4,13,16,20,30, 31,32,33
	wet to mesic		moist open forests and marshy areas, Boreal forests, Rocky Mountains		11,15		
coarse			arctic and alpine meadows among rocks, Boreal forests, Rocky Mountains		9		
			banks and wooded slopes, parklands and Boreal forests	locally common	7,10,12, 13,14		
med. to coarse	dry	saline, drought, alkaline	sand-dunes, dry banks, rocky slopes, prairies and parklands, excellent erosion control	common	1,3,4	cultivar	4,7,13,16,20,32, 34
fine to coarse	dry		open sandy and gavelly places, Boreal forests	common	13,14,15		
fine to med.	wet to mesic	saline, flood, acidic, alkaline	shores and marshes, riverbanks and lake shores, Boreal forests, excellent erosion control	common		cultivar	27,28
fine to med.	wet to mesic	drought, saline, acidic, alkaline	alpine meadows, forest borders, open slopes, bogs, Rocky Mountains, Cypress Hills, good erosion control		5,9,10,15		4

GRASSES AND GRASS-LIKE PLANTS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Phragmites australis/communis</i> common reed grass	P	(1.5-3.0m) erect solitary, sod	rhizomes, stolons/seeds	9140 seeds/g	early cool	W-poor L-poor	increaser	
<i>Poa alpina</i> alpine bluegrass	P	(0.1-0.3m) erect sod	seeds, tillers	2200 seeds/g	early, late cool mycorrhizal	W-excellent L-excellent		
<i>Poa arctica</i> arctic bluegrass	P	(0.1-0.3m) erect bunch	rhizomes/seeds, tillers		early cool			
<i>Poa arida</i> plains bluegrass	P	(0.2-0.5m) erect bunch	rhizomes/seeds, tillers		early cool			
<i>Poa canbyi</i> Canby bluegrass	P	(0.5-1.0m) erect bunch	seeds, tillers	2040 seeds/g	early cool	W-good L-good	decreaser	
<i>Poa cusickii</i> early bluegrass	P	(0.2-0.6m) erect solitary, bunch	seeds, tillers		early cool	L-fair	increaser	
<i>Poa glauca</i> bluegrass	P	(0.1-0.6m) erect bunch	seeds, tillers		early cool	L-excellent	increaser/ decreaser	
<i>Poa interior</i> woodland bluegrass	P	(0.2-0.5m) erect bunch, sod	seeds, tillers		early cool	L-excellent	decreaser	
<i>Poa juncifolia</i> alkali bluegrass	P	(0.5-1.0m) erect bunch	rhizomes/seeds, tillers		early, late cool			
<i>Poa palustris</i> fowl bluegrass	P	(0.3-1.0m) erect bunch	seeds, tillers		early cool	W-excellent L-excellent	increaser/ decreaser	
<i>Poa pratensis</i> Kentucky bluegrass Introduced Elements	P	(0.3-0.8m) erect sod	rhizomes/seeds, tillers	4800 seeds/g	early cool	W-good L-excellent	invader	
<i>Poa sandbergii</i> sandberg bluegrass	P	(0.15-0.3m) erect bunch	seeds, tillers	2040 seeds/g	early cool	L-fair	increaser	
<i>Puccinellia nuttalliana</i> Nuttall's alkali grass	P	(0.3-0.6m) erect sod, bunch	seeds	6140 seeds/g	early, late cool	W-excellent L-excellent	increaser/ decreaser	
<i>Schizachne purpurascens</i> purple oat grass	P	(0.4-0.8m) erect solitary, bunch	rhizomes/seeds		early, late	L-fair	increaser	
<i>Scirpus acutus</i> great bulrush	P	(0.5-3.0m) erect solitary, sod	rhizomes/seeds	1070 seeds/g	late cool			
<i>Scirpus microcarpus</i> small-fruited bulrush	P	(0.3-1.0m) erect solitary	stolons/seeds		late			
<i>Scirpus paludosus/maritimus</i> prairie bulrush	P	(0.2-0.7m) erect solitary, sod	rhizomes/seeds	360 seeds/g	late cool		increaser	

GRASSES AND GRASS-LIKE PLANTS

HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
fine to coarse	wet to mesic	alkaline	marshes and lakes, parklands and Boreal forests		10,13		
fine to coarse	mesic to dry	drought, acidic	subalpine to alpine meadows and rocky slopes, Rocky Mountains, Boreal forest, good erosion control	common	8,9	cultivar, ecovar	13,20,30,32
			alpine and high boreal meadows, Rocky Mountains, Boreal forests		9		
	mesic to dry	saline	dry plains, saline meadows, prairies and parklands		3,4,13,14		
fine to coarse	mesic to dry	alkaline, drought, saline	dry to moist grasslands, alkaline meadows, prairies, parklands		1,3,4	cultivar	
	dry		dry grasslands and sand hills, prairies, parklands		1,2,3,4, 7,8,10		
coarse			rocky slopes at subalpine to alpine elevations, Boreal forests, Rocky Mountains		9,13,15		32
	dry		dry plains and open woods, sandy slopes Boreal forest, Rocky Mountains		4,13		
	wet to mesic	alkaline	moist alkaline meadows, prairies		1,3,4		
	wet to mesic		moist meadows and open woods, throughout Alberta		3,4,10, 12,13, 14,15		4,16,20,28,32
fine to med.	mesic	flood, acidic, alkaline	lawns, pastures, meadows, moist prairies, forest openings, throughout Alberta, excellent erosion control	common	2,3,4,5,7, 8,10	cultivar	
fine to coarse	dry	acidic, alkaline, drought	dry plains, prairies and parklands	common	1,3,4		4
fine to med.	wet to mesic	alkaline, flood, saline	moist alkaline soils, throughout Alberta	common	1,3,4		4,20,31,32
			open conifer woods in northern prairies	locally common	7,10,12, 13,14		
fine to med.	wet	alkaline, flood	marshes and lake shores, sloughs, prairies and parklands		3,4		5
	wet		marshes, bogs, Boreal forests and parklands		12		5
fine	wet	alkaline, saline	alkaline marshes and lakeshores, saline flats, throughout Alberta		3,4		

GRASSES AND GRASS-LIKE PLANTS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Scirpus pungens</i> three-square rush	P	(0.1-0.8m) erect solitary	rhizomes/seeds		late			
<i>Scirpus validus</i> common great bulrush	P	(0.5-2.5m) erect thicket	rhizomes/seeds		late			
<i>Scolochloa festuacea</i> spangle top	P	(0.8-1.2m) erect solitary	rhizomes/seeds		early	L-poor	decreaser	
<i>Sitanion hystrix</i> squirreltail	P	(0.1-0.5m) erect bunch	seeds, tillers	420 seeds/g	early cool	W-fair L-fair		
<i>Spartina gracilis</i> alkali cord grass	P	(0.4-1.0m) erect solitary	rhizomes/seeds		late warm	L-poor	increaser	
<i>Sporobolus cryptandrus</i> sand dropseed	P	(0.3-0.8m) erect bunch	seeds	11670 seeds/g	early warm	W-fair L-fair	decreaser	
<i>Stipa columbiana</i> Columbia needle grass	P	(0.4-0.6m) erect bunch	seeds, tillers	330 seeds/g	early cool	W-good L-good	decreaser	
<i>Stipa comata</i> needle and thread grass	P	(0.3-0.7m) erect bunch	seeds, tillers	250 seeds/g	late cool	W-good L-good	increaser/ decreaser	
<i>Stipa curtisetia/spartea</i> western porcupine grass	P	(0.4-0.6m) erect bunch	rhizomes/seeds		late cool	L-good	decreaser	
<i>Stipa richardsonii</i> Richardson needle grass	P	(0.5-1.0m) erect bunch	seeds		early, late cool	L-excellent	decreaser	
<i>Stipa viridula</i> green needle grass	P	(0.4-0.8m) erect bunch	seeds, tillers	stratify 400 seeds/g	early cool	W-good L-good	increaser/ decreaser	
<i>Trisetum spicatum</i> spike trisetum	P	(0.1-0.5m) erect bunch	seeds, tillers		early cool mycorrhizal	W-good L-fair	increaser/ decreaser	
<i>Vulpia octoflora</i> six-weeks fescue	A	(0.1-0.3m) erect solitary, bunch	seeds		early cool	W-poor L-poor	increaser	

GRASSES AND GRASS-LIKE PLANTS

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
		wet	saline	marshes and shores, often saline, prairies and parklands		3,4		
		wet		lakes, marshes, ponds, throughout Alberta	common	3,4		5,28
		wet	flood	shallow water, marshes, throughout Alberta	locally common	3,4		
	fine to coarse	dry	saline, alkaline, drought	dry plains and dry open woods, prairies	rare	1		13
		wet to dry	saline, alkaline	saline meadows, sandy soils, prairies and parklands	common	3,4		5,16
	med. to coarse	dry	drought	dry sandy soils, grasslands and open woods, prairies, parklands	common	1,3,4		20
	med.	dry	drought	prairie grasslands and open woods, prairies, Rocky Mountains, Peace River, Cypress Hills		6,7,8		
	coarse	dry	alkaline, drought	dry plains in prairies, parklands and Peace River	common	1,3,4	cultivar, ecovar	4,13,16,20,31, 32,33
	med.	mesic		moist prairie grasslands, prairies, parklands, and Rocky Mountains	common	1,3,4,6	cultivar, ecovar	13,16,31
		mesic		moist grasslands, Rocky Mountains, Cypress Hills, parklands		2,7,8,10		
	fine to med.	mesic to dry	drought, alkaline	moderately dry to moist areas in shrubbery, forest margins, throughout prairies and parklands	common	1,2,3,4, 6,7	cultivar, ecovar	4,16,20,27,31, 32,33,34
	coarse	mesic to dry	drought, acidic, alkaline	open woods and mountain slopes, good erosion control	scattered	7,8,9,10, 13,14,15	ecovar	
	coarse	mesic		moist open ground, sterile ground, depleted rangeland, prairies	scattered	1		

FORBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Achillea millefolium</i> common yarrow	P	(0.3-0.8m) erect solitary, mat	rhizomes/seeds aggressive	stratify 6100 seeds/g	early cool mycorrhizal	W-poor L-poor	increaser	
<i>Aconitum delphinifolium</i> monkshood	P	(0.3-0.7m) erect solitary	seeds		late	W-toxic L-toxic		
<i>Actaea rubra</i> baneberry	P	(0.3-0.8m) erect solitary	rhizomes, seeds		early	W-toxic L-toxic	decreaser	
<i>Agoseris glauca</i> false dandelion	P	(0.1-0.4m) erect solitary, mat	seeds		early cool mycorrhizal	W-fair L-fair	increaser	
<i>Agrimonia striata</i> agrimony	P	(0.5-1.2m) erect solitary	rhizomes, seeds					
<i>Allium cernuum</i> nodding onion	P	(0.1-0.5m) erect solitary	seeds	scarify & stratify	early cool mycorrhizal	L-fair	decreaser	
<i>Allium schoenoprasum</i> wild chives	P	(0.2-0.6m) erect solitary	seeds			L-fair		
<i>Allium textile</i> prairie onion	P	(0.1-0.3m) erect solitary	seeds	scarify & stratify 400 seeds/g	cool mycorrhizal	L-fair	increaser	
<i>Anaphalis margaritacea</i> pearly everlasting	P	(0.2-0.6m) erect solitary/bunch	rhizomes/seeds aggressive	19400 seeds/g	warm			
<i>Anemone canadensis</i> Canada anemone	P	(0.2-0.7m) erect solitary	seeds		early	L-poor	increaser/ decreaser	
<i>Anemone cylindrica</i> long-fruited anemone	P	(0.2-0.8m) erect solitary	seeds	no treatment 1100 seeds/g	early cool	L-poor	decreaser	
<i>Anemone lithophila</i> Drummond's anemone	P	(0.1-0.25m) erect solitary	seeds		early			
<i>Anemone multifida</i> cut-leaved anemone	P	(0.1-0.5m) erect solitary	seeds	no treatment 600 seeds/g	early, late cool mycorrhizal	W-fair L-poor	increaser	
<i>Anemone occidentalis</i> chalice-flower	P	(0.1-0.6m) erect solitary	seeds		late			
<i>Anemone parviflora</i> small wood anemone	P	(0.1-0.3m) erect solitary	rhizomes, seeds		early			
<i>Anemone patens/Pulsatilla ludoviciana</i> prairie crocus	P	(0.1-0.4m) erect solitary, bunch	seeds	stratify 1000 seeds/g	early, late cool mycorrhizal	L-toxic	increaser	
<i>Antennaria alpina</i> alpine everlasting	P	(0.05-0.1m) trailing-erect mat	stolons/seeds		early		increaser	

FORBS

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
	med. to coarse	wet to dry	drought, acidic	grasslands, open woods, waste areas, excellent erosion control	common	2,3,4,5,6, 7,8,10,11, 13,14,15		2,4,6,7,11,20, 26,31,33
				montane woods, alpine meadows		11		
		mesic		moist woods		5,12		13
		wet to mesic		grasslands, mountain slopes, open woods, waste areas	scattered	2,7,8		
				borders of woods, poplar woods, roadsides	locally common			
		wet to mesic		grasslands, open woods, thickets, rocky slopes	locally common	2,6,7,8		8,13,16
		wet to mesic		wet meadows, banks, shores	rare			11
		dry		grasslands, hill sides	locally common			6,8,16,26
	med. to coarse	mesic to dry		open woods in foothills and mountains, dry pastures				5,13
		wet		damp meadows, thickets, sandy shores	common	3,4,12,13, 14		6,13,26,31
		mesic to dry		grasslands, open dry woods	locally common	2,3,4,7		2,7,11,24,26,31
				alpine slopes, meadows, ridges		9		
	coarse	mesic		grasslands, dry open woods	common	1,2,6,7, 8,9,10,12, 13,14		2,6,8,11,13,16,24 26,31
		mesic		moist alpine meadows		9		7
		mesic		moist banks and slopes, montane to alpine elevations, Boreal forests		9,13		
	coarse	mesic		grasslands, dry open woods	common	1,2,3,4,7, 12		2,5,6,8,16,24, 26,31
				alpine meadows, openings, slopes, southern Rocky Mountains	rare	9		

FORBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Antennaria aprica</i> low everlasting	P	(< 0.15m) trailing-erect mat	stolons/seeds		early		increaser	
<i>Antennaria lanata</i> woolly everlasting	P	(0.1-0.2m) erect solitary	seeds		early		increaser	
<i>Antennaria parvifolia/nitida</i> small-leaved everlasting	P	(0.1-0.2m) trailing-erect mat	stolons/seeds aggressive	stratify	early cool mycorrhizal	L-poor	increaser/ invader	
<i>Antennaria pulcherrima</i> showy everlasting	P	(0.2-0.5m) erect bunch/solitary	seeds		early		increaser	
<i>Antennaria rosea</i> rosy everlasting	P	(0.1-0.2m) trailing-erect mat	stolons/seeds		early cool mycorrhizal	W-poor L-poor	increaser	
<i>Antennaria umbrinella</i> dwarf pussy-toes	P	(0.08-0.15m) trailing-erect mat	stolons/seeds aggressive	stratify	cool		increaser	
<i>Apocynum androsaemifolium</i> spreading dogbane	P	(0.2-1.0m) erect solitary	rhizomes/seeds		early			
<i>Aquilegia flavescens</i> yellow columbine	P	(0.2-0.6m) erect solitary	rhizomes/seeds	880 seeds/g	warm	L-poor		
<i>Aquilegia formosa</i> sitka columbine	P	(0.2-0.6m) erect solitary	rhizomes/seeds	880 seeds/g	cool	L-poor		
<i>Arabis divaricarpa</i> purple rock cress	B/P	(0.4-0.8m) erect solitary	seeds		early			
<i>Arabis lyrata</i> lyre-leaved rock cress	BP	(0.1-0.4m) erect bunch	seeds		early			
<i>Aralia nudicaulis</i> wild sarsaparilla	P	(0.3-0.6m) erect solitary	rhizomes/seeds	stratify 220 seeds/g	early, late cool	L-poor	increaser/ decreaser	
<i>Arenaria congesta</i> rocky-ground sandwort	P	(0.1-0.3m) erect bunch, mat	rhizomes/seeds	stratify	cool mycorrhizal	L-poor	invader	
<i>Arnica chamissonis</i> leafy arnica	P	(0.2-0.8m) erect solitary	rhizomes/seeds		early			
<i>Arnica fulgens/sororia</i> shining/twin arnica	P	(0.2-0.6m) erect solitary	rhizomes, seeds	stratify 1000 seeds/g	early cool	L-poor	increaser	
<i>Arnica latifolia/cordifolia</i> mountain/heart-leaved arnicas	P	(0.2-0.6m) erect solitary	rhizomes/seeds		early	L-poor/toxic	increaser	
<i>Arnica lonchophylla</i> spear-leaved arnica	P	(0.2-0.4m) erect solitary	rhizomes/seeds		early			

FORBS

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
		dry		dry prairies, open areas	common	3,4,8		26
				alpine and subalpine meadows, southern Rocky Mountains		9		
		mesic to dry	saline	prairies, dry open areas	common	3,4,6,8,14		16,24
		wet to mesic		open woods, moist grasslands, Boreal forest	scattered	8		
		mesic to dry		prairies, dry open areas	locally common	6		13
	coarse	dry		dry gravelly slopes, southern Rocky Mountains, Cypress Hills	scattered			
	fine to med.	dry		sandy areas, dry woods	common	12		
	med. to coarse	mesic		open woods, rocky slopes, moist meadows				5,13
	med.	mesic		open woods, rocky slopes at lower elevations	rare			
	fine	dry		dry sandy slopes, prairies, parklands		3,4		
	fine	dry		open sandy woods, dunes	scattered	13		
		wet to mesic		moist shady woods, deep wooded ravines	common	10,11,12, 13		
	coarse	mesic to dry		dry plains, slopes, Cypress Hills	scattered			
		wet to mesic		moist meadows, thickets, Boreal forest, Peace River	scattered	5,10,14		
		wet to mesic		moist meadows, grasslands	locally common	1,10		13
		wet to mesic		moist montane woods, meadows, southern Rocky Mountains	common	7,8,10,11		
		mesic		dry open montane slopes, shores, calcareous soils, Boreal forest	scattered			

FORBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Artemisia campestris</i> northern wormwood	PB	(0.3-0.6m) erect solitary	seeds		early warm mycorrhizal			
<i>Artemisia dracunculus</i> dragonwort	P	(0.5-1.0m) erect solitary	rhizomes, seeds			L-poor	increaser	
<i>Artemisia frigida</i> pasture sagewort	P	(0.1-0.4m) erect mat	rhizomes/seeds aggressive	9990 seeds/g	early cool mycorrhizal	W-good L-poor	increaser	
<i>Artemisia ludoviciana</i> prairie sagewort	P	(0.3-0.6m) erect bunch/mat	rhizomes/seeds aggressive	9900 seeds/g	early warm mycorrhizal	W-fair L-poor	increaser	
<i>Aster alpinus</i> alpine aster	P	(0.05-0.2m) erect solitary	seeds		early warm		decreaser	
<i>Aster borealis</i> rush aster	P	(0.1-0.8m) erect solitary	rhizomes/seeds		early warm		increaser/ decreaser	
<i>Aster ciliolatus</i> Lindley's aster	P	(0.2-1.0m) erect solitary, bunch	rhizomes/seeds		early warm	L-fair	increaser/ decreaser	
<i>Aster conspicuus</i> showy aster	P	(0.3-0.9m) erect solitary	rhizomes/seeds		early warm	L-good	decreaser	
<i>Aster engelmannii</i> elegant aster	P	(0.3-1.2m) erect solitary	rhizomes/seeds	440 seeds/g	warm		decreaser	
<i>Aster ericoides</i> tufted white prairie aster	P	(0.3-0.8m) erect bunch	rhizomes/seeds aggressive		early warm mycorrhizal	L-good	increaser/ decreaser	
<i>Aster falcatus</i> creeping white prairie aster	P	(0.3-0.8m) erect bunch/mat	rhizomes/seeds		early, late warm		decreaser	
<i>Aster hesperius</i> western willow aster	P/A	(0.5-1.2m) erect solitary	rhizomes/seeds		early warm		decreaser	
<i>Aster laevis</i> smooth aster	P	(0.4-1.0m) erect solitary/bunch	rhizomes/seeds	no treatment	early, late warm mycorrhizal	L-good	increaser/ decreaser	
<i>Astragalus aboriginum</i> Indian milk vetch	P	(0.1-0.4m) erect bunch	seeds		early N fixation	L-toxic		
<i>Astragalus alpinus</i> alpine milk vetch	P	(0.1-0.3) erect/trailing mat/solitary	rhizomes/seeds		early N fixation			
<i>Astragalus americanus</i> American milk vetch	P	(0.5-1.0m) erect solitary	seeds	230 seeds/g	early N fixation	L-toxic		
<i>Astragalus bisulcatus</i> two-grooved milk vetch	P	(0.4-1.0m) erect bunch/solitary	seeds	stratify & scarify 300 seeds/g	early cool N fixation	W-toxic L-toxic	increaser	

FORBS

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
		dry		prairies, shores, open sandy woods, Boreal forest openings	common	3,4,6,7, 10,13,14		
				dry hills, prairies	common			
	med. to coarse	dry	drought	prairies, open areas, to alpine elevation	common	1,3,4,6, 7,10		4,5,20,26,31
	med. to coarse	mesic		moist prairies, open areas, shores	common	3,4,6		4,20
				prairies to dry alpine slopes, southern Rocky Mountains		7,8,9,11		
	med.	wet		marshy ground, bogs, parklands, and Boreal forest	common	3,4,10, 12,13,14		
				woodlands, clearings, parklands, and Boreal forest	common	4,7,10,12, 13,14		26
				woodlands, clearings, parklands, and Boreal forest	common	7,10,11, 12,13,14		
	med.	mesic		open montane woods, alpine meadows, southern Rocky Mountains				
		wet to mesic		dry open areas, prairies, roadsides	common	1,3,4		6,8,13,16,24, 26,31
		mesic to dry		dry open areas, prairies	common	1,3,4,6		7
		wet to mesic		stream banks, ditches, moist ground	common	3,4,10,12, 14		
		mesic		moist prairie, open woodlands	common	2,3,4,5,6, 7,8		2,6,7,8,13,16,20, 24,26,31
	coarse			gravel banks along rivers and slopes, to alpine elevations		2,6,7,8,10		
		mesic		moist banks, rocky slopes, open areas, Boreal forest, Rocky Mountains		8,13		
		mesic		moist woods, riverbanks, openings, Boreal forest, Rocky Mountains		7		
	med. to coarse	mesic to dry	high selenium content	prairies, coulees, alluvial flats		6		6,8,16

FORBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Astragalus crassicaarpus</i> buffalo bean	P	(0.1-0.4m) trailing mat	seeds	scarify 200 seeds/g	early, late cool N fixation	L-toxic	decreaser	
<i>Astragalus dasyglottis</i> purple milk vetch	P	(0.05-0.2m) trailing-erect mat	rhizomes/seeds		early N fixation			
<i>Astragalus drummondii</i> Drummond's milk vetch	P	(0.4-0.8m) erect bunch, solitary	seeds	scarify 285-350 seeds/g	early, late cool N fixation	L-toxic		
<i>Astragalus flexuosus</i> slender milk vetch	P	(0.3-1.0m) trailing-erect solitary	rhizomes/seeds		early cool N fixation	L-toxic		
<i>Astragalus gilviflorus</i> cushion milk vetch	P	(< 0.05m) erect mat	seeds	scarify 700 seeds/g	cool N fixation	L-toxic		
<i>Astragalus missouriensis</i> milk vetch	P	(0.02-0.1m) trailing-erect solitary, bunch	seeds		early, late cool N fixation	L-toxic		
<i>Astragalus pectinatus</i> narrow leaved milk vetch	P	(0.2-0.6m) erect-trailing bunch, solitary	seeds	scarify 200 seeds/g	early cool N fixation	W-poor L-toxic	increaser	
<i>Astragalus striatus</i> ascending purple milk vetch	P	(0.2-0.4m) erect-trailing bunch	seeds	scarify 700 seeds/g	early cool N fixation	L-toxic		
<i>Astragalus tenellus</i> loose-flowered milk vetch	P	(0.2-0.5m) erect solitary, bunch	seeds		early N fixation			
<i>Astragalus vexilliflexus</i> few-flowered milk vetch	P	(0.1-0.3m) erect mat	seeds		late N fixation			
<i>Balsamorhiza sagittata</i> balsam-root	P	(0.1-0.3m) erect solitary	seeds	120 seeds/g	early cool	W-good L-fair	increaser	
<i>Besseyia wyomingensis</i> kitten-tails	P	(0.15-0.3m) erect solitary	seeds	stratify 2000 seeds/g	cool			
<i>Caltha leptosepala</i> mountain marigold	P	(0.1-0.4m) erect solitary	rhizomes, seeds		late			
<i>Campanula rotundifolia</i> harebell	P	(0.2-0.4m) erect solitary, bunch	rhizomes, seeds	stratify 2640 seeds/g	early warm mycorrhizal	L-poor	increaser	
<i>Castilleja miniata</i> common red paint-brush	P	(0.2-0.6m) erect solitary	seeds		late warm parasitic	W-fair L-poor	increaser	
<i>Castilleja occidentalis/sulphurea</i> lance-leaved paint-brush	P	(0.1-0.4m) erect-trailing solitary, bunch	seeds	9900 seeds/g	early, late warm parasitic	W-fair L-poor	increaser	
<i>Castilleja raupii</i> purple paint-brush	P	(0.3-0.5m) erect solitary	seeds		early warm parasitic	W-fair L-poor	increaser	

HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
med.	mesic to dry		grasslands, prairies, parklands	locally common	2,3,4,8,10		6,26,31
	mesic		moist woods, plains, meadows		3,4,5,6,8,12,13		
	mesic to dry		dry hillsides, prairies		3,4,10		8,16
	mesic		prairies, dry gravelly areas		1,3,4		
coarse	dry		dry eroded prairies, rocky outcrops				
coarse	mesic to dry		prairies, gravel flats		2,8,10		
fine to med.	mesic to dry	alkaline high selenium content	grasslands, slopes		1		8,16
	dry		dry grasslands, open slopes		3,4,5,6,8,12,13		26,31
			prairies, gravel flats, coulees, forest margins, shores		2,6,8		8,16
			dry slopes, gravel banks, roadsides	locally common			
med.	mesic		grassland, open montane woods, southern Rocky Mountains	locally common	7		4,8,13,16,20,33
	mesic		open slopes, dry grasslands, to alpine elevations				
	wet		wet alpine meadows		9		
med. to coarse	mesic to dry		dry meadows, hillsides, open woods, to alpine elevations	common	2,6,7,8,10,12,14		2,6,8,13,16,24,26,31
			open pine woods, meadows		7,10		20
med.	wet to mesic		open woodlands, foothills, mountains	common	7,10		
			open moist forests, forest margins, bogs, Boreal forest, Peace River		14		

FORBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Castilleja rhexifolia</i> splitleaf indian paint-brush	P	(0.1-0.4m) erect solitary	seeds	10800 seeds/g	early, late warm parasitic	W-fair L-poor	increaser	
<i>Cerastium arvense</i> mouse-eared chickweed	P	(0.1-0.3m) erect mat	seeds aggressive	no treatment	early cool	L-poor	increaser/ invader	
<i>Chenopodium pratericola</i> narrow-leaved goosefoot	A	(< 0.8m) erect solitary	seeds		early	L-poor	invader	
<i>Chrysosplenium iowense</i> golden saxifrage	P	(0.03-0.15m) erect solitary	stolons/seeds					
<i>Cicuta bulbifera</i> bulb-bearing water hemlock	P	(0.3-0.8m) erect solitary	rhizomes, seeds		early cool	W-toxic L-toxic		
<i>Cicuta maculata</i> water hemlock	P	(0.6-1.8m) erect solitary	rhizomes, seeds		early cool	W-toxic L-toxic	invader	
<i>Cleome serrulata</i> bee plant	A	(0.3-0.8m) erect solitary	seeds	stratify 200 seeds/g	early warm			
<i>Comandra umbellata</i> bastard toad-flax	P	(0.1-0.3m) erect solitary, bunch	rhizomes/seeds		early cool mycorrhizal, parstic			
<i>Coreopsis tinctoria</i> common tickseed	A	(0.4-1.0m) erect solitary	seeds	3080 seeds/g	warm			
<i>Cornus canadensis</i> bunchberry	P	(< 0.2m) erect solitary	rhizomes/seeds	scarify & stratify 150 seeds/g	early cool	L-poor	increaser/ decreaser	
<i>Delphinium bicolor</i> low larkspur	P	(0.2-0.5m) erect solitary	seeds		early cool	W-fair L-toxic	increaser	
<i>Delphinium glaucum</i> tall larkspur	P	(1.0-2.0m) erect solitary	seeds		late warm	W-fair L-toxic	increaser	
<i>Descurainia pinnata</i> tansy mustard	A	(0.05-0.8m) erect solitary	seeds		cool	L-toxic		
<i>Disporum trachycarpum</i> fairy bells	P	(0.3-0.8m) erect solitary	rhizomes/seeds		early	L-fair	decreaser/ invader	
<i>Dodecatheon conjugens</i> mountain shooting star	P	(0.1-0.2m) erect solitary	seeds	stratify 3300 seeds/g	early, late cool mycorrhizal	L-poor	increaser	
<i>Dodecatheon pulchellum</i> saline shooting star	P	(0.05-0.2m) erect solitary	seeds		early cool	L-poor	increaser	
<i>Draba incerta</i> whitlow-grass	P	(0.15-0.2m) erect bunch	seeds		early			

FORBS

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
	med.	wet to mesic		subalpine and alpine slopes		7,10		
		mesic to dry		dry plains, hills, mountains	common	6		
		wet to mesic	alkaline	slough margins, open disturbed areas		1,3,4		
		wet		shady streambanks, marshy ground, wet coniferous Boreal forests	locally common			
		wet		swamps, wet meadows, parklands, Boreal forests	common	12,14		
		wet		marshes, ditches, wet places	common	3,4,12,14		
	fine to med.	mesic to dry		disturbed prairies, roadsides	common	1,3,4		6,13
		mesic to dry		prairie grassland, gravelly slopes, dry open pine woods	common	3,4,6,13, 14,15		
	med. to coarse	dry	drought	clay flats, slough margins, moist places	common		cultivar	
		mesic	acidic	moist shady woods	common	5,8,10,11, 12,13,14		5
		dry to mesic		grasslands, open woods	locally common	2,8		
		mesic		meadows, stream banks, moist woods, to subalpine elevations		10,11		2,7,11
		dry		dry open areas, waste areas	scattered			
		mesic		moist woods, ravines, coulees, prairies parklands, southern Boreal forest		12		13,24
		wet to mesic		moist grasslands	common	5,7,8,11		8,16,24,33
		wet to mesic	saline	wet meadows, saline flats	common	3,4,11		2
		dry		dry open areas from montane to alpine elevations		9		

FORBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Draba nivalis</i> whitlow-grass	P	(0.01-0.1m) erect bunch	seeds		early			
<i>Draba oligosperma</i> whitlow-grass	P	(0.02-0.06m) erect bunch	seeds		early			
<i>Dryas drummondii</i> yellow mountain avens	P	(0.05-0.2m) erect mat	stolons/seeds		late N fixation	W-poor L-poor		
<i>Epilobium angustifolium</i> fireweed	P	(0.1-3.0m) erect solitary	rhizomes/seeds aggressive	stratify & scarify 18720 seeds/g	early warm	W-good L-fair	increaser/ decreaser	
<i>Epilobium ciliatum</i> northern willow herb	P	(0.05-1.2m) erect solitary	seeds		early warm	L-fair	increaser/ decreaser	
<i>Erigeron aureus</i> yellow daisy	P	(0.02-0.15m) erect solitary	seeds		early	L-poor	increaser	
<i>Erigeron caespitosus</i> tufted fleabane	P	(0.1-0.25m) erect bunch	seeds		early cool mycorrhizal	L-poor	increaser	
<i>Erigeron canadensis</i> horseweed	A	(0.2-1.5m) erect solitary			early	L-poor	increaser	
<i>Erigeron compositus</i> compound fleabane	P	(0.05-0.15m) erect bunch	seeds		early	L-poor	increaser	
<i>Erigeron glabellus</i> smooth fleabane	PB	(0.1-0.5m) erect solitary	seeds		early cool	L-poor	increaser	
<i>Erigeron humilis</i>	P	(0.02-0.25m) erect solitary	seeds		early	L-poor	increaser	
<i>Erigeron peregrinus</i> wandering daisy	P	(0.1-0.7m) erect solitary	rhizomes/seeds		early	L-poor	increaser	
<i>Erigeron philadelphicus</i> Philadelphia fleabane	BP	(0.2-0.7m) erect solitary	seeds		early	L-poor	increaser	
<i>Erigeron speciosus</i> showy fleabane	P	(0.15-0.8m) erect solitary	seeds	3520 seeds/g	early warm	L-poor	increaser	
<i>Eriogonum flavum</i> yellow umbrella plant	P	(0.2-0.3m) erect solitary	seeds	stratify 450 seeds/g	early cool mycorrhizal	L-poor	increaser	
<i>Eriogonum umbellatum</i> umbrella plant	P	(0.1-0.3m) erect solitary, mat	seeds	460 seeds/g	warm			
<i>Erysimum asperum</i> prairie rocket	P	(0.1-0.4m) erect solitary	seeds		early			

FORBS

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
	coarse	dry		dry alpine slopes and screes		9		
	coarse			alpine slopes and screes		9		
	coarse	mesic to dry	drought, alkaline	gravelly slopes, river bars, roadsides, excellent erosion control	locally common	9		2,13
	fine to coarse	mesic	alkaline, acidic	open woodlands, forest edges, recently burned sites, roadsides, prairies, parklands, Boreal forests	common	4,7,8,10, 11,12,13, 14,15		2,6,7,8,16,24,31
	fine to coarse	wet to mesic	alkaline, acidic	sloughs, wet prairies, good erosion control	common	3,4,10,12, 13,14,15		
				alpine slopes and meadows, southern Rocky Mountains		9		
		dry		dry hillsides and prairies	common	6,7		16,24,26,37
		dry		disturbed areas, fields, roadsides	common	1,3,4,13, 14		
		dry		eroded hillsides, badlands, dry gravelly ridges, prairies and southern Rocky Mountains	scattered	7,10		8,16
		mesic		open moist woods, meadows, prairies	locally common	2,3,4,5,6, 7,8,12,13, 14		26
		mesic		moist alpine slopes		9		
		mesic		moist banks, meadows, open montane woods, southern Rocky Mountains		9		
		mesic		moist open woods, clearings, disturbed areas	locally common	12		31
	med. to coarse	mesic		moist open woods, montane meadows, southern Rocky Mountains		2,7		
		dry		dry plains, rocky outcrops, badlands, throughout prairies	common	7		8,16,26
	med. to coarse	dry	drought	dry plains, foothills, southern Rocky Mountains			cultivar	
	fine	dry		dry sandy prairies	locally common	1,3,4		

FORBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Fragaria vesca</i> woodland strawberry	P	(0.05-0.2m) erect solitary	stolons/seeds		early cool	L-poor	increaser	
<i>Fragaria virginiana/glauca</i> wild strawberry	P	(< 0.1m) erect solitary, mat	stolons/seeds aggressive	stratify	early cool	W-poor L-poor	increaser	
<i>Gaillardia aristata</i> blanket flower	P	(0.3-0.6m) erect solitary	seeds	no treatment 450 seeds/g	early warm mycorrhizal	L-poor	increaser	
<i>Galium boreale</i> northern bedstraw	P	(0.3-0.6m) erect solitary, bunch	rhizomes/seeds aggressive	no treatment	early cool mycorrhizal	L-excellent	increaser	
<i>Galium labradoricum</i>	P	(0.1-0.3m) erect solitary	seeds		early			
<i>Galium trifidum</i> small bedstraw	P	(0.1-0.3m) trailing/erect mat	seeds		early	L-poor	increaser	
<i>Gaura coccinea</i> scarlet butterfly-weed	P	(0.1-0.4m) trailing-erect solitary	rhizomes/seeds		early warm mycorrhizal			
<i>Gentianella amarella</i> northern gentian	BA	(0.05-0.5m) erect solitary, bunch	seeds		early			
<i>Geranium richardsonii</i> wild white geranium	P	(0.4-0.8m) erect solitary	seeds		early warm	W-poor L-poor		
<i>Geranium viscosissimum</i> sticky purple geranium	P	(0.2-0.9m) erect solitary	seeds	scarify 110 seeds/g	late cool mycorrhizal	L-excellent	decreaser	
<i>Geum aleppicum</i> yellow avens	P	(0.4-1.0m) erect solitary	rhizomes/seeds	stratify 800 seeds/g	cool	L-poor	invader	
<i>Geum rivale</i> purple avens	P	(0.4-1.0m) erect solitary	rhizomes/seeds		early			
<i>Geum triflorum</i> old man's whiskers	P	(0.2-0.4m) erect solitary	rhizomes/seeds	stratify 2000 seeds/g	early cool mycorrhizal	L-poor	increaser/ decreaser	
<i>Glycyrrhiza lepidota</i> wild licorice	P	(0.3-1.0m) erect solitary, thicket	rhizomes/seeds aggressive	no treatment 150 seeds/g	early cool N fixation			
<i>Grindelia squarrosa</i> gumweed	PB	(0.3-0.6m) erect solitary	seeds	stratify 1200 seeds/g	early warm mycorrhizal	W-poor L-poor	increaser/ invader	
<i>Gutierrezia sarothrae</i> broomweed	P	(0.1-0.3m) erect bunch	seeds	2000 seeds/g	early warm mycorrhizal	W-fair L-toxic	increaser/ invader	
<i>Habenaria viridis</i> bracted orchid	P	(0.1-0.5m) erect solitary	seeds		early	L-poor		

FORBS

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
	coarse	mesic		dry to moist open woods, often sandy, Boreal forests	common	13,14		
		wet to mesic		low moist prairies, open woodlands	common	2,7,8, 10,12,13, 14		
	fine to coarse	mesic to dry	drought	prairie grasslands, dry open areas, roadsides	common	2,3,4,7,8		2,5,6,8,13,16,20, 24,26,31,33
		wet to mesic		woodlands, moist prairie valleys, roadsides	common	2,4,5,7,8, 13,14		6,7,8,16,26,31
		wet to mesic		marshy ground, moist woods, bogs		15		
		wet to mesic		marshy ground, stream banks, bogs, parklands, Boreal forests	scattered	15		
		mesic to dry		prairie grasslands, roadsides	common	1		26
		mesic		moist woods, meadows, roadsides, throughout prairies	locally common	5,7,8,10, 11,14		
		mesic		moist thickets, open woods, Rocky Mountains, Cypress Hills	locally common	12		13
	med.	wet to mesic		moist grassland slopes, coulees, open woodlands, southern Rocky Mountains	locally common	2,7,8		2,5,8,11,13,16,24
		wet to mesic		moist woods, meadows	common			6,24,26,31
		wet to mesic		stream banks, marshes, wet meadows, Boreal forests, Cypress Hills	scattered	8,10		
		wet to dry		foothills, prairies	common	1,2,5,7,8, 11		2,6,7,8,13,16,24, 26,31
		wet to mesic		moist prairies, shores, coulees	common	1,3,4		6,31
		wet to dry	saline	dry prairie, roadsides, saline flats	common	1,3,4		31
	fine to coarse	dry	drought	dry prairies	common	1		8,16
		wet to mesic		moist meadows, woods	locally common	15		

FORBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Haplopappus spinulosus</i> spiny iron plant	P	(0.1-0.4m) erect bunch	seeds		early warm			
<i>Hedysarum alpinum</i> American sweet vetch	P	(0.2-0.7m) erect solitary/thicket	seeds aggressive	scarify 200 seeds/g	early N fixation	W-excellent L-excellent	decreaser	
<i>Hedysarum boreale</i> northern sweetvetch	P	(0.2-0.6m) erect solitary	seeds	scarify 70 seeds/g	early cool N fixation	W-excellent L-excellent	decreaser	
<i>Hedysarum sulphurescens</i> yellow sweetvetch	P	(0.2-0.6m) erect solitary	seeds	scarify 70 seeds/g	early N fixation	L-fair	decreaser	
<i>Helianthus annuus</i> annual sunflower	A	(0.6-1.2m) erect solitary	seeds aggressive	stratify 130 seeds/g	early warm			
<i>Helianthus maximiliani</i> Maximilian sunflower	P	(0.5-2.5m) erect solitary, bunch	rhizomes/seeds aggressive	500 seeds/g	warm			
<i>Helianthus nuttallii</i> common tall sunflower	P	(0.5-2.0m) erect solitary	rhizomes/seeds					
<i>Heracleum lanatum</i> cow parsnip	P	(1.0-2.0m) erect solitary, bunch	seeds		early	L-fair	decreaser	
<i>Heterotheca villosa</i> hairy golden aster	P	(0.2-0.5m) erect solitary, bunch	rhizomes/seeds	stratify 2500 seeds/g	early warm mycorrhizal	W-poor L-poor	increaser	
<i>Heuchera cylindrica</i> sticky alum-root	P	(0.2-0.5m) erect solitary	rhizomes, seeds		early			
<i>Heuchera richardsonii</i> alum-root	P	(0.3-0.4m) erect solitary	rhizomes, seeds	no treatment	early, late cool	L-poor	increaser	
<i>Hieracium umbellatum</i> narrow-leaved hawkweed	P	(0.2-1.0m) erect solitary	rhizomes/seeds		early	W-good L-fair	decreaser	
<i>Iris missouriensis</i> rocky mountain iris	P	(0.2-0.5m) erect solitary	rhizomes/seeds	50 seeds/g	cool			
<i>Iva axillaris</i> poverty weed	P	(0.1-0.5m) erect bunch	rhizomes/seeds aggressive		early			
<i>Lactuca pulchella</i> blue lettuce	P	(0.3-0.6m) erect bunch	rhizomes/seeds aggressive		early warm			
<i>Lathyrus ochroleucus</i> cream-coloured pea vine	P	(< 1.0m) climbing solitary	rhizomes/seeds	scarify & stratify	early, late cool N fixation	L-excellent	increaser/ decreaser	
<i>Lathyrus venosus</i> purple pea vine	P	(0.5-1.0m) climbing solitary	rhizomes/seeds		early, late cool N fixation	L-excellent	decreaser	

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
		mesic to dry		dry plains, hillsides, roadsides	locally common	1		
	fine to med.	mesic to dry	drought, saline, alkaline	moist open woods and slopes, gravelly banks to alpine elevation, Boreal forest	common	2,3,4,5,7, 8,9,10,11, 15		6,13,24,26
	fine to coarse	mesic to dry	drought, saline, alkaline	moist plains, open slopes, open woods	locally common	2,3,4,7, 9,10,11, 13		2,8,13,16
	fine to med.	mesic to dry	drought, saline, alkaline	prairie grasslands, mountain woods, southern Rocky Mountains	locally common	7,8,9,11		
	med. to coarse	mesic to dry	drought	roadsides, waste areas, eroded slopes	common	1,2		
	fine to coarse	mesic to dry	drought, flood	roadsides, waste areas, prairies	common			
		wet to mesic	saline	moist meadows, slough margins, wet roadsides, prairies	common			2,13
		mesic		moist shady woods, clearings, ditches	common	7,11,12, 13		
	med. to coarse	dry		dry sandy prairies, hillsides	common	1,2,3,4,12		6,20,26
	coarse			rocky slopes, ledges, southern Rocky Mountains	scattered	2,10		
		wet to mesic		open sandy ground, rocky shores and slopes, moist areas throughout prairies, parklands, southern Boreal forests	common	1,3,4,13		6,13,24,26,31
		dry		open woods, clearings, meadows, disturbed areas, Boreal forests, Rocky Mountains	locally common	4,13,14		
	fine to med.	wet		marshy ground	rare			5
	med.	mesic	saline	saline clay flats, banks, eroded slopes	locally common	1		
		wet to mesic		moist meadows, woods, clearings, roadsides	common	1,3,4		
	med.	wet to mesic		moist open woods, clearings, Boreal forests, montane pine forests, aspen parklands, excellent erosion control	common	4,7,8,10, 11,12,13, 14,15		
				moist open woods, thickets, eastern parklands and Boreal forests	common	3,4,12		6

FORBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Liatris punctata</i> blazing star	P	(0.2-0.6m) erect-trailing solitary	rhizomes/seeds	stratify 200 seeds/g	early warm mycorrhizal	W-good L-good	decreaser	
<i>Lilium philadelphicum</i> western wood lily	P	(0.3-0.6m) erect solitary	seeds		early	L-fair	increaser/ decreaser	
<i>Linnaea borealis</i> twin-flower	P	(< 0.1m) trailing mat, solitary	seeds		early		increaser	
<i>Linum lewisii</i> wild blue flax	P	(0.2-0.7m) erect solitary	seeds aggressive	no treatment 800 seeds/g	early cool mycorrhizal	L-poor		
<i>Lithospermum ruderale</i> stone-seed	P	(0.2-0.5m) erect bunch	seeds	stratify 40 seeds/g	late cool	L-poor		
<i>Lomatium dissectum</i> mountain wild parsnip	P	(0.3-1.2m) erect solitary	seeds					
<i>Lomatium macrocarpum</i> long-fruited parsley	P	(0.1-0.5m) erect-trailing solitary	seeds	150 seeds/g	early cool			
<i>Lupinus argenteus</i> silvery lupine	P	(0.5-1.0m) erect solitary, bunch	seeds aggressive	scarify 50-70 seeds/g	early cool N fixation	W-toxic L-toxic	increaser	
<i>Lupinus sericeus</i> silky lupine	P	(0.4-0.8m) erect solitary	seeds	60-280 seeds/g	early cool N fixation	W-toxic L-toxic	increaser	
<i>Lygodesmia juncea</i> skeleton weed	P	(0.1-0.4m) erect bunch	rhizomes/seeds	stratify	early cool mycorrhizal		increaser	
<i>Maianthemum canadense</i> lily-of-the-valley	P	(0.05-0.2) erect solitary	rhizomes/seeds		early cool	L-poor	increaser/ decreaser	
<i>Melampyrum lineare</i> cow wheat	A	(0.1-0.4m) erect solitary	seeds		early			
<i>Mentha arvensis</i> wild mint	P	(0.2-0.5m) erect solitary	rhizomes/seeds		early cool		decreaser	
<i>Mertensia paniculata</i> tall lungwort	P	(0.2-0.8m) erect solitary	seeds		early, late	L-fair	increaser/ decreaser	
<i>Mitella nuda</i> Bishop's-cap	P	(0.02-0.1m) trailing-erect solitary	rhizomes/seeds		early	L-poor	increaser/ invader	
<i>Moehringia lateriflora</i> blunt-leaved sandwort	P	(0.05-0.2m) trailing-erect mat	rhizomes/seeds					
<i>Monarda fistulosa</i> horse mint	P	(0.3-0.7m) erect solitary	rhizomes/seeds aggressive	no treatment 3300 seeds/g	early warm mycorrhizal	L-poor		

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
		dry		dry sandy grasslands and hillsides	common	1		2,4,5,6,8,11,13, 16,24,26,31
		mesic		open woodlands, moist meadows	scattered	10,12		26,31
		mesic		cool woodlands, often on decaying wood	common	7,8,10,11, 12,13,14		9
	med. to coarse	mesic to dry	drought	grasslands, dry open woods, prairies and parklands	common	2,3,4,6, 7,8,10	cultivar	2,4,6,8,16,20,24, 26,31,33
		wet to mesic		dry slopes, grasslands, Cypress Hills, Rocky Mountains	locally common	2,8		24
				open montane woods, rocky slopes	scattered			
		mesic		dry rocky hillsides, prairies	scattered	7		
	n to coarse	mesic to dry	drought, alkaline	submontane prairie slopes, ridges, southern Rocky Mountains, good erosion control	locally common	2,7		5,6,8,16,24
	med. to coarse	mesic to dry	drought	grasslands, open montane woods, southern Rocky Mountains		2,5,7,8, 10		2,5,13
	fine	dry		dry sandy southern and central prairies	common	1,3,4		
		mesic		moist woods, throughout prairies	common	10,12,13, 14		
	fine	dry		dry sandy ground, pine woods, Boreal forest	locally common	12,13,14		
		wet	flood	marshy ground, sloughs, throughout prairies	common	3,4,10, 12,13,14		7,31
		mesic		moist woodlands, shady streambanks, parklands, Boreal forests, Rocky Mountains	common	7,8,10,11, 12,13,15		
		wet to mesic		cold wet woodlands, Rocky Mountains, Boreal forests	locally common	11,13,14		
		wet to mesic		moist meadows, gravelly shores, thickets, moist woods	common			
	med.	mesic		open woods, fields, roadsides, shady banks and coulees	common	2,3,4,7,8		2,6,7,8,13,16,24, 26,31,33

FORBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Musineon divaricatum</i> leafy musineon	P	(0.1-0.2m) trailing, erect solitary	seeds	400 seeds/g	late cool			
<i>Oenothera biennis</i> yellow evening primrose	B	(0.5-1.5m) erect solitary	seeds	stratify 3500 seeds/g	early warm			
<i>Oenothera caespitosa</i> butte primrose	P	(0.1-0.12m) erect solitary	seeds	no treatment 1980 seeds/g	cool			
<i>Oenothera nuttallii</i> white evening primrose	P	(0.4-1.0m) erect solitary	rhizomes/seeds		early warm mycorrhizal			
<i>Orthilia secunda</i> one-sided wintergreen	P	(0.02-0.04m) erect mat	rhizomes/seeds aggressive		early			
<i>Orthocarpus luteus</i> owl-clover	A	(0.1-0.4m) erect solitary	seeds					
<i>Osmorhiza depauperata</i> sweet cicely	P	(0.2-0.6m) erect solitary	seeds		early	W-excellent L-good	decreaser	
<i>Osmorhiza occidentalis</i> sweet anise	P	(0.3-1.0m) erect solitary	seeds	60-70 seeds/g	cool	W-excellent L-good	decreaser	
<i>Oxytropis campestris/cusickii</i> alpine locoweed	P	(0.2-0.5m) erect bunch	seeds	scarify 800 seeds/g	cool N fixation	W-toxic L-toxic	increaser	
<i>Oxytropis deflexa</i> reflexed locoweed	P	(0.1-0.35m) trailing-erect solitary	seeds		early N fixation	L-toxic	increaser	
<i>Oxytropis monticola/campestris</i> late yellow locoweed	P	(0.1-0.4m) erect bunch	seeds	scarify	early warm N fixation	W-toxic L-toxic	increaser	
<i>Oxytropis podocarpa</i> inflated oxytrope	P	(< 0.05m) erect bunch	seeds		early N fixation	L-toxic	increaser	
<i>Oxytropis sericea</i> early yellow locoweed	P	(0.1-0.3m) erect bunch	seeds	scarify 500 seeds/g	early cool N fixation	W-toxic L-toxic	increaser	
<i>Oxytropis splendens</i> showy locoweed	P	(0.1-0.4m) erect bunch	seeds		early N fixation	L-toxic	increaser	
<i>Oxytropis viscida</i> viscid locoweed	P	(0.1-0.25m) erect bunch	seeds		early cool N fixation	L-toxic	increaser	
<i>Parnassia palustris</i> northern grass of parnassus	P	(0.1-0.3m) erect solitary	seeds		late	L-fair	increaser	
<i>Pedicularis bracteosa</i> western lousewort	P	(0.1-1.0m) erect solitary	seeds		early			

HABITAT					DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:					
		dry		dry prairies, southern parklands	locally common	7		
	coarse	mesic		dry open prairies	common	1,12		2,6,7,13,24,31
	fine to med.	mesic	drought	dry hillsides, clay flats, roadsides				5,8,16
	fine	mesic		light sandy soils, roadsides, cultivated fields, prairies and parklands	common	1,3,4		
				woodlands, bluffs, throughout prairies	locally common	10,15		
		dry		dry prairie grasslands	common			24
				moist woods		7,10		
	med.	mesic		montane woods, meadows, southern Rocky Mountains				
	coarse to med.	mesic to dry	drought, saline, alkaline	rock slides, stony ridges, alpine and subalpine meadows, excellent erosion control				
				open woods, moist thickets, and banks, parklands, Boreal forests and Rocky Mountains		5,15		
	coarse to med.	mesic to dry	drought, saline, alkaline	prairies, open woods, moist banks, excellent erosion control	common	1,2,3,4,5,7,8		2
				exposed rocky ridges and turf alpine hillsides, Rocky Mountains		9		
		dry		prairies and dry hillsides	common	1,2,3,4,7,8		2,8,16,24,26
				grassy slopes, open woods, gravelly banks, Boreal forests, parklands, Rocky Mountains	locally common	2,7,8,13,14		2,13,26
		mesic to dry		dry banks, hillsides, southwestern Alberta, prairies, parklands		2,7,8		
		wet		wet shady places, Boreal forests	common	10,11,13		
		mesic		moist woodlands, open montane slopes, Rocky Mountains, Cypress Hills	locally common	9		

FORBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Pedicularis flammea</i> flame-coloured lousewort	P	(0.06-0.1m) erect solitary	seeds		early			
<i>Pedicularis groenlandica</i> elephant head	P	(0.3-0.5m) erect solitary	seeds		early, late	L-poor		
<i>Pedicularis labradorica</i> Labrador lousewort	BP	(0.1-0.3m) erect bunch	seeds		late			
<i>Penstemon confertus</i> yellow beard-tongue	P	(0.1-0.5m) erect bunch	seeds		early cool	L-fair	increaser	
<i>Penstemon ellipticus</i> creeping beard-tongue	P	(0.1-0.2m) trailing mat	seeds		early	L-fair	increaser	
<i>Penstemon fruticosus</i> shrubby beard-tongue	P	(0.1-0.4m) erect bunch	seeds		early	L-fair	increaser	
<i>Penstemon nitidus</i> smooth blue beard-tongue	P	(0.2-0.3m) erect bunch	seeds	stratify 750 seeds/g	early cool mycorrhizal	L-fair	increaser	
<i>Penstemon procerus</i> slender blue beard-tongue	P	(0.15-0.4m) erect bunch	seeds aggressive	stratify	early cool	L-fair	increaser	
<i>Petalostemon candidum</i> white prairie clover	P	(0.2-0.8m) erect/trailing solitary	seeds	scarify	early, late warm N fixation	W-excellent L-excellent	decreaser	
<i>Petalostemon purpureum</i> purple prairie clover	P	(0.3-0.8m) erect, trailing solitary	seeds	scarify 550 seeds/g	early, late warm N fixation	W-excellent L-excellent	decreaser	
<i>Petasites palmatus</i> palmate-leaved coltsfoot	P	(0.1-0.5m) erect solitary	rhizomes/seeds aggressive		early cool	L-poor	increaser	
<i>Petasites sagittatus</i> arrow-leaved coltsfoot	P	(0.1-0.3m) erect solitary	rhizomes/seeds aggressive		early cool	L-poor	increaser	
<i>Phacelia sericea</i> silky scorpion weed	P	(0.1-0.4m) erect bunch	seeds		early			
<i>Phlox hoodii</i> moss phlox	P	(0.03-0.05m) trailing bunch, mat	stolons/seeds aggressive		early cool mycorrhizal	L-poor	increaser	
<i>Physaria didymocarpa</i> double bladder-pod	P	(< 0.1m) trailing bunch	seeds		early			
<i>Polemonium acutiflorum/caeruleum</i> Jacob's ladder	P	(0.4-1.0m) erect solitary	rhizomes/seeds		early			
<i>Polygonum amphibium/coccineum</i> water smartweed	P	(0.05-0.15m) erect bunch	rhizomes/seeds			L-good		

FORBS

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
				arctic and alpine meadows, Boreal forests, northern Rocky Mountains		9		
		wet		boggy meadows, marshes, Boreal forests and Rocky Mountains	locally common	10,11		33
				moist woodlands, bogs, northeastern Boreal forests		15		
		wet to mesic		meadows, moist open woods, southern Rocky Mountains	common	2,5,7,8		8,16
				rocky banks and slopes at subalpine elevations, southern Rocky Mountains		9		
		dry		dry rocky slopes at subalpine and alpine elevations, southern Rocky Mountains	rare	9		5,13
		dry		dry hills, eroded areas, prairies, parklands, Rocky Mountains	common	2,7,10		2,6,8,13,16,24,26
		wet to mesic		meadows, slough margins, open woods, prairies, parklands, Rocky Mountains	common	2,5,7,8,11		13,26
	fine to coarse	dry	drought	prairie grasslands, dry slopes, gravel flats, prairies and parklands	common	1,2,7		2,6,8,16,31
	fine to coarse	mesic to dry	drought	prairie grasslands, eroded slopes, dry banks, prairies	common	1,2,3,4,7	cultivar	2,4,6,8,13,16,20,26,31,33
		wet		moist woods, swamps, parklands and Boreal forests	common	8,11,14		
		wet	flood	wet meadows, bogs, widespread throughout northern Alberta	common	8,13		
				open woods, slopes, to subalpine elevations, Rocky Mountains		2		
	coarse	mesic to dry		eroded grasslands, shallow soils, prairies	common	1,2		
				dry slopes and plains, Rocky Mountains		7,10		
		wet		marshy ground, wet meadows		15		
		wet	flood	shallow water, shores, swamps, ditches	common			

FORBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Polygonum viviparum</i> alpine bistort	P	(0.1-0.3m) erect solitary	rhizomes/seeds		early	L-poor	invader	
<i>Potentilla anserina</i> silverweed	P	(0.1-0.2m) trailing bunch	stolons/seeds aggressive		early cool mycorrhizal	L-poor	increaser	
<i>Potentilla arguta</i> white cinquefoil	P	(0.4-1.0m) erect solitary	seeds		early		increaser	
<i>Potentilla concinna</i> early cinquefoil	P	(< 0.1m) trailing solitary	rhizomes/seeds		early cool		increaser	
<i>Potentilla diversifolia</i> smooth-leaved cinquefoil	P	(0.1-0.4m) erect solitary	seeds		early		increaser	
<i>Potentilla gracilis</i> graceful cinquefoil	P	(0.3-0.7m) erect-trailing bunch	seeds	no treatment	early cool		increaser	
<i>Potentilla hippiana</i> woolly cinquefoil	P	(0.2-0.4m) erect bunch	seeds		early		increaser	
<i>Potentilla nivea</i> snow cinquefoil	P	(0.05-0.15m) erect bunch	seeds		early		increaser	
<i>Potentilla ovina/plattensis</i> low cinquefoil	P	(0.05-0.15m) erect-trailing bunch	seeds		early		increaser	
<i>Potentilla palustris</i> marsh cinquefoil	P	(0.2-0.6m) erect bunch	rhizomes/seeds		early	L-poor	increaser	
<i>Potentilla pensylvanica</i> prairie cinquefoil	P	(0.2-0.7m) erect solitary	seeds		early		increaser	
<i>Potentilla tridentata</i> three-toothed cinquefoil	P	(0.1-0.3m) erect bunch	rhizomes/seeds		early	L-poor	increaser	
<i>Potentilla uniflora</i>	P	(0.2-1.0m) erect bunch	seeds		early		increaser	
<i>Primula incana</i> mealy primrose	P	(0.1-0.4m) erect solitary	seeds		early			
<i>Psoralea argophylla</i> silver-leaf psoralea	P	(0.3-0.6m) erect solitary	rhizomes/seeds		early cool		increaser	
<i>Psoralea lanceolata</i> scurf pea	P	(0.2-0.6m) erect solitary	rhizomes/seeds		early	L-poor	increaser	
<i>Pyrola asarifolia</i> common pink winter green	P	(0.15-0.25m) erect solitary	seeds		early		increaser/ decreaser	

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
		wet to mesic		moist woods, meadows to high alpine elevations, Rocky Mountains		11		
		wet to mesic		lake shores, river flats, wet places, throughout prairies	common	3,4		24,26
		wet to mesic		moist places, slough margins on prairie	common	3,4		6,26,31
		dry		dry sandy prairies, parklands, and southern Rocky Mountains	common	10		
		wet to mesic		moist montane meadows to alpine elevations, southern Rocky Mountains	locally common	2,8,11		8,13,16
		mesic	alkaline	prairie grasslands, open woods, prairies to southern Boreal forests		2,3,4,5,6, 7,8,10,11		13
				dry prairies and valleys, southwestern Alberta	locally common	3,4,6		13
				alpine, subalpine and arctic meadows, Boreal forests and Rocky Mountains		9		
	coarse	dry		dry rocky slopes from foothills to alpine elevations	scattered	9		
		wet	flood	marshes, bogs, lake margins, Boreal forests		12		
		mesic		dry prairies and open slopes	common	1,3,4,6,8, 13,14		26,31
	fine	dry		open sandy pine woods, Boreal forests	locally common	13,14		
	coarse			rocky alpine slopes		9		
			saline	marshy ground and shores, saline meadows, prairies and parklands	locally common	3,4		
		mesic to dry		dry to moist grasslands throughout prairies and parklands	common	3,4		
	fine	dry		sandy ground and dunes	common	1		
		wet to mesic		moist woods	locally common	4,10,11, 14,15		

FORBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Pyrola chlorantha</i> greenish-flowered wintergreen	P	(0.08-0.2m) erect solitary	seeds		early		increaser	
<i>Pyrola elliptica</i> white wintergreen	P	(0.12-0.25m) erect solitary	seeds		early		increaser	
<i>Ranunculus cardiophyllus</i> heart-leaved buttercup	P	(0.1-0.4m) erect solitary	seeds		late	W-toxic L-toxic	increaser	
<i>Ranunculus cymbalaria</i> seaside crowfoot	P	(0.05-0.2m) erect, trailing solitary, mat	stolons/seeds aggressive		early cool	W-toxic L-toxic	increaser	
<i>Ranunculus eschscholtzii</i>	P	(0.1-0.5m) erect solitary	seeds		early		increaser	
<i>Ranunculus gmelinii</i> yellow water crowfoot	P	(< 0.1m) erect solitary, mat	stolons/seeds		early		increaser	
<i>Ranunculus macounii</i> Macoun's buttercup	AP	(0.3-0.7m) erect solitary, mat	stolons/seeds		early	W-toxic L-toxic	increaser	
<i>Ranunculus sceleratus</i> cursed crowfoot	AP	(0.2-0.6m) erect solitary	seeds	scarify	early cool	W-toxic L-toxic	increaser	
<i>Ratibida columnifera</i> prairie coneflower	P	(0.3-0.5m) erect solitary	seeds	no treatment 3000 seeds/g	early warm mycorrhizal	W-good L-fair		
<i>Rorippa palustris</i> yellow cress	AB	(0.2-0.6m) erect bunch	seeds					
<i>Rubus arcticus</i> dwarf raspberry	P	(< 0.15m) erect solitary	rhizomes/seeds		late		decreaser	
<i>Rubus chamaemorus</i> cloudberry	P	(0.1-0.3m) erect solitary	rhizomes/seeds		early			
<i>Rubus pedatus</i> dwarf bramble	P	(< 1.0m) trailing mat	stolons/seeds					
<i>Rubus pubescens</i> dewberry	P	(0.1-1.0m) trailing, climbing solitary	stolons/seeds		early		increaser/ decreaser	
<i>Rumex acetosa</i> ssp. <i>alpestris</i> green sorrel	P	(0.2-0.8m) erect solitary	rhizomes/seeds		early	L-poor	increaser/ invader	
<i>Rumex maritimus</i> goldon dock	A	(0.2-0.6m) erect bunch	seeds		early	L-poor	increaser/ invader	
<i>Rumex occidentalis</i> western dock	P	(0.5-1.5m) erect solitary	seeds		early	L-poor	increaser/ invader	

FORBS

HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
	wet to mesic		moist coniferous woods	scattered	10,15		
	wet to mesic		rich coniferous woods, Boreal forests	scattered	4,14		
	wet to mesic		moist places, meadows, stream banks, open woods, western parklands	scattered	11		
	wet	saline	borders of ponds, lakes, stream banks, saline wet areas	common	3,4,12		
	wet to mesic		moist alpine slopes and meadows		9		
	wet		ponds, ditches, streams, lake shores	scattered	12		
	wet		alluvial thickets, moist woods, and meadows	locally common	3,4,12		
	wet		ditches, marshes, ponds and lake shores	common	3,4,12		
med.	mesic to dry	drought	dry prairies, roadsides	common	1,2		2,4,5,6,8,13,16 20,24,26,31,33
	wet		lakeshores, sloughs, and wet places	common			
	wet to mesic	acidic	boggy woods, marshes, Boreal forests		8,10,11, 13,15		9
	wet to mesic	acidic	bogs, often in sphagnum moss, Boreal forests		10,11,13, 15		
	wet to mesic	acidic	moist woods, mossy banks, Rocky Mountains, western parklands, Boreal forests		8		
	wet to mesic		moist woods, parklands, boreal forests	common	8,10,11		
			moist banks and meadows, to alpine elevations		9		
	wet to mesic	saline	moist and saline places, lake flats	common	3,4,14		
	wet to mesic		wet or moist, throughout western Alberta	common	10,13,14		13

FORBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Rumex triangulivialis</i> narrow-leaved dock	P	(0.3-0.6m) erect-trailing solitary	seeds		early	L-poor	increaser/ invader	
<i>Rumex venosus</i> wild begonia	P	(0.1-0.4m) erect solitary	rhizomes/seeds		early	L-poor	increaser/ invader	
<i>Salicornia rubra</i> sampire	A	(0.05-0.25m) erect solitary	seeds		early			
<i>Sanicula marilandica</i> snake-root	P	(0.3-0.6m) erect solitary	rhizomes/seeds			L-fair	increaser	
<i>Scutellaria galericulata</i> marsh skullcap	P	(0.3-0.6m) erect bunch	rhizomes/seeds		early warm			
<i>Selaginella densa</i> little club-moss	P	(< 0.03m) erect mat	seeds		late	W-poor L-poor	increaser	
<i>Senecio canus</i> prairie groundsel	P	(0.1-0.4m) erect bunch	seeds	no treatment 1400 seeds/g	early cool mycorrhizal	L-poor	increaser	
<i>Senecio pauperculus</i> balsam groundsel	P	(0.1-0.6m) erect solitary	seeds		early	L-poor	increaser	
<i>Senecio triangularis</i> brook ragwort	P	(0.3-1.5m) erect bunch	seeds		early	L-poor	increaser	
<i>Silene acaulis</i> moss campion	P	(0.03-0.06m) erect mat	seeds		early			
<i>Sisyrinchium montanum</i> blue eyed grass	P	(0.1-0.5m) erect bunch	rhizomes/seeds		early cool mycorrhizal	L-poor		
<i>Sium suave</i> water parsnip	P	(0.5-1.0m) erect solitary	rhizomes/seeds		early	W-toxic L-toxic		
<i>Smilacina stellata</i> star flowered Solomon's-seal	P	(0.2-0.6m) erect solitary	rhizomes/seeds aggressive	stratify 50 seeds/g	early cool	W-good L-good	increaser	
<i>Smilacina trifolia</i> three-leaved Solomon's-seal	P	(0.1-0.2m) erect solitary	rhizomes/seeds		late cool			
<i>Solidago canadensis</i> Canada goldenrod	P	(0.3-1.0m) erect solitary, bunch	rhizomes/seeds aggressive		early warm	L-poor	increaser	
<i>Solidago missouriensis</i> Missouri goldenrod	P	(0.1-0.6m) erect solitary, bunch	rhizomes/seeds aggressive	stratify	early warm	W-good L-poor	increaser	
<i>Solidago multiradiata</i> alpine goldenrod	P	(0.1-0.5m) erect solitary, bunch	rhizomes/seeds aggressive		early warm	L-poor	increaser	

FORBS

HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
	wet to mesic		moist open places		3,4,14		
	dry		dry sandy soils, dunes, roadsides	common	1,3,4		
		saline	saline lake shores and sloughs	common	1		
	wet to mesic		moist, rich woodlands, throughout prairies	common			
	wet		wet meadows and along stream banks	locally common	10,12,13, 14		
fine	dry		dry prairie, open sandy hills, eroded spots	locally common	1,2,3,4,10		
	mesic to dry		dry open, often rocky areas, to alpine elevations	scattered	7		8,16
	wet to mesic	saline	moist meadows, shores, open woods, roadsides, parklands, Boreal forests		10,13,14		
	wet to mesic		along stream and wet places, southern Rocky Mountains		10,13		
coarse			alpine meadows, scree fields, Rocky Mountains	locally common	9		
	mesic		moist open meadows, throughout prairies and parklands	common	2,3,4,5,8		2,8,13,16,26
	wet		wet meadows and sloughs, throughout Alberta	common	3,4,12		
	wet to mesic		moist shores, open woods, and prairies	common	13,15		24,26
	wet	flood	bogs and wet woods, usually in sphagnum moss	common	11		
fine to coarse	mesic to dry	drought	open woods, moist meadows, parklands, Boreal forests	common	2,4,5,8, 12,13		13,31
	mesic to dry		dry prairies and hillsides, prairies and southern parklands	common	1,2,3,4,6, 14		2,8,13,16,24,26
	wet to mesic		Boreal and montane or alpine meadows		7,9		

FORBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE
<i>Solidago rigida</i> stiff goldenrod	P	(0.3-0.8m) erect solitary, bunch	rhizomes/seeds aggressive	stratify 1700 seeds/g	early warm mycorrhizal	L-poor	increaser
<i>Solidago spathulata</i> mountain goldenrod	P	(0.1-0.4m) erect solitary, bunch	rhizomes/seeds aggressive		early warm	L-poor	increaser
<i>Sphaeralcea coccinea</i> scarlet globemallow	P	(0.1-0.3m) erect-trailing mat	rhizomes/seeds aggressive	scarify 1100 seeds/g	early cool	W-good L-poor	increaser
<i>Spiranthes romanzoffiana</i> ladies' tresses	P	(0.1-0.4m) erect solitary	seeds		early		
<i>Stachys palustris</i> hedge nettle	P	(0.3-0.8m) erect bunch, thicket	rhizomes/seeds aggressive		early warm		
<i>Suaeda calceoliformis</i> sea-blite	A	(< 0.5m) erect, trailing bunch	seeds		early		
<i>Thalictrum occidentale</i> western meadow rue	P	(0.5-1.0m) erect solitary	rhizomes/seeds aggressive		early cool	L-poor	increaser
<i>Thalictrum venulosum</i> veiny meadow rue	P	(0.2-0.9m) erect solitary	rhizomes/seeds aggressive	stratify 430 seeds/g	early cool	L-poor	increaser
<i>Thermopsis rhombifolia</i> golden bean	P	(0.1-0.4m) erect bunch	rhizomes/seeds aggressive	scarify & stratify 50 seeds/g	early cool N fixation	L-toxic	increaser
<i>Triglochin maritima</i> seaside arrow-grass	P	(< 0.5m) erect bunch	rhizomes/seeds		early	L-toxic	increaser
<i>Triglochin palustris</i> slender arrow-grass	P	(0.1-0.4m) erect solitary	rhizomes, stolons /seeds		early	L-toxic	
<i>Trollius albiflorus</i> globe flower	P	(0.2-0.4m) erect solitary	seeds		late		
<i>Valeriana dioica</i> northern valerian	P	(0.3-0.7m) erect solitary	seeds		late		
<i>Vicia sparsifolia/americana</i> American vetch	P	(0.3-1.0m) climbing solitary, bunch	seeds	scarify 60 seeds/g	early, late cool N fixation	W-excellent L-excellent	decreaser
<i>Viola adunca</i> early blue violet	P	(0.04-0.1m) erect-trailing solitary	rhizomes/seeds	stratify	early cool	L-poor	increaser
<i>Viola canadensis</i> western Canada violet	P	(0.1-0.4m) erect mat	rhizomes/seeds aggressive		early cool	L-poor	increaser
<i>Viola palustris</i> marsh violet	P	(< 0.1m) erect solitary	rhizomes, stolons /seeds		early cool	L-poor	increaser

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
	med. to coarse	mesic to dry		prairies and woodland openings, dry sandy soils throughout Alberta	common	3,4		6,26,31
		mesic		grasslands, open woods to alpine elevations, prairies, parklands and southern Boreal forests	common	6,12,13,14		
	med. to coarse	dry	alkaline, drought	prairie grasslands, roadsides		1,3,4,6		4,6,26,33
		wet		bogs, wet meadows, throughout Alberta		14		
		wet		wet meadows, moist open woods, throughout Alberta	common	3,4,10,12,13,14		13
			saline	saline flats, slough borders, prairies and parklands	common	1		
		wet to mesic		shady moist woods and coulees, Rocky Mountains, Cypress Hills, Peace River		9		
		wet to mesic		woods, thickets, moist prairies, throughout Alberta	locally common	4,5,7,8,10,11,12,13,14		24,26,31
		mesic		dry sandy grassland, roadsides, prairies and parklands	common	1,3,4		2,6,7,8,16,24,26
		wet	saline	brackish marshes, bogs	common	3,4		
		wet	saline	brackish marshes, shores, bogs	locally common	3,4		
		wet to mesic		moist alpine and subalpine banks and meadows		9		
		wet		wet meadows, bogs, Boreal forests	locally common	10		
	med. to coarse	mesic		open woods, meadows, shores, throughout Alberta, good erosion control	common	1,4,7,10,11,12,13,14,15		24
		mesic		grasslands, open woods, prairies, parklands, southern Boreal forests	locally common	4,11		26
		wet to mesic		moist shady woods and meadows	common	4,5		
		wet to mesic		cold bogs, stream banks, Boreal forests and Rocky Mountains	locally common	14		

FORBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Viola renifolia</i> kidney-leaved violet	P	(< 0.1m) erect solitary	rhizomes/seeds		early cool	L-poor	increaser	
<i>Zigadenus elegans</i> white camas	P	(0.2-0.6m) erect solitary	seeds		early, late	W-toxic L-toxic	increaser	
<i>Zigadenus venenosus</i> death camas	P	(0.2-0.35m) erect solitary	seeds		early cool	W-toxic L-toxic	increaser	
<i>Zizia aptera</i> meadow parsnip	P	(0.2-0.6m) erect solitary	seeds	stratify 850 seeds/g	late cool		increaser	

FORBS

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
		wet to mesic		moist woods, bogs, eastern parklands, Boreal forests		14		
		wet to mesic	saline	moist meadows and open woods, throughout Alberta	common	7,10		13,26
		mesic		grassy sloughs and uplands, southern and southwestern prairies	locally common	1,8		
		wet to mesic		moist meadows, throughout Alberta	common	8		13,26,31

SHRUBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Alnus crispa</i> green alder	P	(1.0-3.0m) erect solitary, thicket	seeds, tillers	stratify 2820 seeds/g	early, late cool N fixation	L-fair	increaser/ invader	
<i>Amelanchier alnifolia</i> saskatoon	P	(1.0-6.0m) erect solitary, thicket	rhizomes, stolons /seeds	stratify 100 seeds/g	early cool	W-excellent L-fair	decreaser	
<i>Arctostaphylos uva-ursi</i> bearberry	P	(0.5-1.0) trailing mat	stolons/seeds	scarify & stratify 80 seeds/g	early cool mycorrhizal	W-good L-fair	increaser	
<i>Artemisia cana</i> silver sagebrush	P	(0.3-1.5m) erect solitary	rhizomes/seeds	no treatment 1870 seeds/g	early warm mycorrhizal	W-good L-fair	increaser	
<i>Artemisia tridentata</i> big sagebrush	P	(0.1-2.0m) erect solitary	seeds	no treatment 5400 seeds/g	warm	W-fair L-poor	increaser	
<i>Atriplex canescens</i> fourwing saltbrush	P	(0.1-0.4m) trailing solitary	seeds	no treatment 50 seeds/g	warm	W-good L-good/toxic		
<i>Atriplex nuttallii</i> Nuttall's saltbush	P	(0.2-0.6m) erect solitary	seeds	no treatment 245 seeds/g	late warm	W-good L-good	decreaser	
<i>Berberis repens</i> creeping oregon grape	P	(0.1-0.3m) trailing solitary	seeds	stratify 140 seeds/g	cool	L-poor	increaser	
<i>Betula glandulosa</i> bog birch	P	(< 2.0m) erect solitary	seeds, tillers	no treatment 8450 seeds/g	early, late cool	L-poor	increaser	
<i>Betula pumila</i> dwarf birch	P	(< 3.0m) erect solitary	seeds, tillers	no treatment 5330 seeds/g	cool	L-poor	increaser	
<i>Cassiope mertensiana/tetragona</i> white mountain heather	P	(0.1-0.3m) erect-trailing bunch	seeds		late cool			
<i>Ceanothus velutinus</i> snowbrush	P	(1.0-3.0m) erect solitary, thicket	seeds seed banker	stratify 210 seeds/g	cool N fixation	W-poor L-poor		
<i>Chrysothamnus nauseosus</i> rabbit-brush	P	(0.2-0.6m) erect bunch	rhizomes/seeds	no treatment 1530 seeds/g	warm mycorrhizal	W-fair L-toxic	increaser/ invader	
<i>Cornus stolonifera</i> red osier dogwood	P	(1.0-3.0m) erect solitary, thicket	stolons/seeds seed banker	scarify & stratify 40 seeds/g	early cool	L-good	decreaser	
<i>Corylus cornuta</i> beaked hazelnut		(1.0-3.0m) erect solitary, bunch	rhizomes/seeds	stratify 1.2 seeds/g	early cool	L-poor	increaser/ decreaser	
<i>Elaeagnus commutata</i> wolf willow	P	(< 4.0m) erect solitary, thicket	rhizomes/seeds	stratify 8 seeds/g	early cool N fixation	W-fair L-fair	increaser	
<i>Eurotia lanata</i> winter fat	P	(0.2-0.8m) erect solitary	seeds	no treatment 330 seeds/g	late cool	W-good L-good	decreaser	

SHRUBS

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
	med. to coarse	wet to mesic	acidic, flood, alkaline	dry sandy coniferous woods, bog edges, Boreal forests, good erosion control	locally common	8,10,11, 12,13,14		1,9,21
	med. to coarse	mesic to dry	drought, acidic, alkaline	open woods, thickets, coulees, bluffs, throughout Alberta, good erosion control	common	4,6,7,13, 14	cultivar	1,5,9,10,18,21,26, 29,35
	med. to coarse	mesic to dry	drought, acidic	moist to dry woods, open sandy areas, roadsides	common	7,8,11, 12,13,14		1,9,10,15,18,5
	med. to coarse	dry	drought, flood	dry hills, prairies, rare in parklands	common	1		5,9,20
	med.			grasslands, dry montane slopes, southern Rocky Mountains	rare		cultivar	
	fine to coarse		saline, alkaline, drought	saline flats, prairies, hillsides	rare		cultivar	
		dry		badlands, eroded slopes, alluvial flats		1		26
				mountain woods, southern Rocky Mountains				5
		wet		bogs and seepage areas, alpine slopes, open subalpine forest at high altitudes	locally common	10,11,12		5,9,18
		wet		swamps and bogs, Boreal forests and Rocky Mountains		8,11		9,21
		wet to mesic		moist subalpine and alpine slopes, C. mertensiana - southern R. Mountains C. tetragona - northern R. Mountains	locally common	9		
	fine to coarse	dry	drought, acidic	montane slopes, open woods, southern Rocky Mountains, excellent erosion control	rare			1,5,9
	fine to coarse	dry	saline, alkaline	dry open areas, badlands, eroded slopes	locally common			4,5,9
	fine to med.	wet to mesic	alkaline, flood, acidic	moist woods, riverbanks, coulees, throughout Alberta	common	12,13,14	cultivar	1,5,9,10,13, 15,18,19,21,26, 29,35,37
	med.	mesic	flood	thickets and woods, throughout parklands and boreal forests	locally common	3,4,12		9,26
	med.	mesic to dry	saline, acidic, alkaline	grasslands, shores and valleys, prairies and parklands, good erosion control	common	3,4,8		1,8,9,10,15,18, 19,21,26,35,37
	med. to coarse	dry	subalkaline, drought	dry prairies and foothills	common	1	cultivar, ecovar	26

SHRUBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Juniperus communis</i> ground juniper	P	(< 1.0m) trailing mat	seeds	stratify 80 seeds/g	early cool	W-poor L-poor	increaser	
<i>Juniperus horizontalis</i> creeping juniper	P	(0.1-0.3m) trailing mat	seeds		late cool	W-good L-poor	increaser	
<i>Juniperus scopulorum</i> rocky mountain juniper	P	(2.0-3.0m) erect solitary	seeds	stratify 60 seeds/g	cool	W-good L-poor	increaser	
<i>Ledum palustre/groenlandicum</i> Labrador tea	P	(0.3-0.8m) erect solitary	rhizomes/seeds		early, late cool	L-poor	increaser	
<i>Lonicera dioica</i> twining honeysuckle	P	(< 1.0m) climbing solitary	seeds	no treatment	early cool	L-poor	increaser/ decreaser	
<i>Lonicera involucrata</i> bracted honeysuckle	P	(1.0-3.0m) erect solitary	seeds seed banker	stratify 720 seeds/g	early cool	L-poor	increaser/ decreaser	
<i>Menziesia ferruginea</i> false azalea	P	(1.0-2.5m) erect solitary, thicket	seeds		late cool			
<i>Opuntia fragilis</i> brittle prickly pear	P	(0.03-0.1m) erect solitary	seeds		early	L-poor	increaser	
<i>Opuntia polyacantha</i> prickly pear	P	(0.05-0.12m) erect solitary	seeds		early cool	L-poor	increaser	
<i>Oxycoccus microcarpus</i> small bog cranberry	P	(0.1-0.5m) trailing solitary	stolons/seeds		early	L-poor	increaser	
<i>Phyllodoce empetriformis/glanduliflora</i> red/yellow heather	P	(0.1-0.3m) erect-trailing solitary	seeds		late			
<i>Potentilla fruticosa</i> shrubby cinquefoil	P	(0.3-1.5m) erect solitary	seeds	no treatment	early, late cool	W-good L-poor	increaser	
<i>Prunus pensylvanica</i> pin cherry	P	(< 8.0m) erect solitary	rhizomes/seeds	stratify 30 seeds/g	early cool	L-fair	decreaser	
<i>Prunus virginiana</i> chokecherry	P	(< 10m) erect solitary, thicket	rhizomes, tillers /seeds	stratify 10 seeds/g	early cool	W-good L-fair/toxic	decreaser	
<i>Rhus trilobata</i> skunk-bush	P	(1.0-2.0m) erect solitary, thicket	seeds	stratify & scarify 40 seeds/g	cool	W-good L-poor	increaser	
<i>Rhododendron albiflorum</i> white flowered rhododendron	P	(0.5-1.2m) erect solitary, thicket	seeds		late cool	L-toxic		
<i>Ribes aureum</i> golden currant	P	(1.0-2.0m) erect solitary	seeds	stratify 510 seeds/g	cool	W-good L-good	increaser	

SHRUBS

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
	coarse	mesic to dry	acidic, drought	woods and open slopes, light rocky soil, dry southern facing slopes	locally common	3,4,8		1,5,9,18
	fine to coarse	dry	acidic, drought, alkaline	dry banks and sandy hillsides, throughout Alberta, good erosion control	common	1,2,3,4,7	cultivar	1,5,9,26
	med.	dry	alkaline	open rocky areas, southern Rocky Mountains	scattered	8		5,9
		wet	acidic	bogs and wet coniferous woods, northern parklands, Boreal forests, Rocky Mountains	common	8,10,11, 12,13,14, 15		9
				open woods, rocky slopes, throughout Alberta	scattered	12,13		9
	med. to coarse	wet to mesic		moist woods, parklands, Boreal forests, Rocky Mountains	locally common	10,11,12, 13		5,9,21
		mesic	acidic	shady coniferous woods with acid humus, moist slopes and streambanks, montane to subalpine	common	8		
	fine	dry		prairie grasslands, hillsides, clay flats	locally common	1		26
	fine	dry		dry prairies	common	1		6,26
		wet		on wet moss in bogs, swamps and damp woods, Boreal forest	locally common	11,15		
				subalpine and alpine meadows, forest openings, Rocky Mountains		9		
	fine to coarse	mesic to dry	acidic, drought, alkaline, flood	plains and open woods to subalpine elevations, throughout Alberta, good erosion control	common	2,5,7,8, 10,11		1,13,15,21,26,5
		mesic		woods and clearings, often dry and sandy	locally common	4,6,12,13, 14		9,15,17,18,26
	fine to coarse	wet to mesic	drought, saline, acidic, alkaline	woods and clearings, fence rows, prairies, parklands, Boreal forests, and Rocky Mountains, good erosion control	common	4,6	cultivar	1,4,5,9,10,15, 17,18,21,26
	med. to coarse	mesic to dry		coulees and river valleys	scattered		cultivar	4,5,9,15,20
		mesic to dry	acidic	moist coniferous woods, wet glades, always on acidic soils, mountain slopes to subalpine	common	8		
	med.	mesic		river banks and rocky slopes, prairies	locally common			5,9,12,15,18,37

SHRUBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Ribes hudsonianum</i> Hudson Bay currant	P	(1.0-1.5m) erect solitary	seeds	stratify 2130 seeds/g	early cool	L-poor	increaser	
<i>Ribes lacustre</i> bristly black currant	P	(1.0-1.5m) erect solitary, thicket	seeds seed banker	stratify 1130 seeds/g	early cool	L-poor	increaser	
<i>Ribes oxycanthoides</i> wild gooseberry	P	(0.3-0.6m) erect solitary	seeds		early cool	L-poor	increaser	
<i>Ribes triste</i> wild red currant	P	(< 1.0m) erect solitary	rhizomes/seeds		early cool	L-poor	increaser	
<i>Rosa acicularis</i> prickly rose	P	(0.5-2.5m) erect solitary, thicket	rhizomes/seeds seed banker	stratify	early, late warm allelopathic	W-good L-fair	increaser/ decreaser	
<i>Rosa arkansana</i> prairie rose	P	(0.2-0.4m) erect solitary, thicket	rhizomes/seeds seed banker	stratify	early warm allelopathic	W-good L-good	increaser/ decreaser	
<i>Rosa woodsii</i> wild rose	P	(0.5-1.5m) erect thicket/solitary	rhizomes/seeds seed banker	stratify 110 seeds/g	early, late warm allelopathic	W-good L-good	increaser/ decreaser	
<i>Rubus idaeus</i> raspberry	P/B	(1.0-2.0m) erect thicket	rhizomes/seeds seed banker	stratify 720 seeds/g	early cool	W-good L-fair	increaser/ decreaser	
<i>Salix arbusculoides</i> shrubby willow	P	(1.0-4.0m) erect solitary, bunch	tillers/seeds	no treatment	early cool	W-excellent L-good	increaser/ decreaser	
<i>Salix arctica</i> arctic willow	P	(< 0.5m) trailing solitary, bunch	seeds/stolons	no treatment	early cool	W-excellent L-good	increaser/ decreaser	
<i>Salix barrattiana</i> Barratt's willow	P	(0.3-1.5m) erect thicket	tillers/seeds	no treatment	early cool	W-excellent L-good	increaser/ decreaser	
<i>Salix bebbiana</i> beaked willow	P	(0.5-5.0m) erect solitary, thicket	tillers, rhizomes, stolons/seeds	no treatment 5510 seeds/g	early cool	W-excellent L-good	increaser/ decreaser	
<i>Salix brachycarpa</i> short-capsuled willow	P	(0.3-1.5m) erect solitary, thicket	tillers/seeds	no treatment	early cool	W-excellent L-good	increaser/ decreaser	
<i>Salix candida</i> hoary willow	P	(0.4-1.5m) erect solitary, bunch	tillers/seeds	no treatment	early cool	W-excellent L-good	increaser/ decreaser	
<i>Salix discolor</i> pussy willow	P	(2.0-11m) erect solitary, bunch	tillers/seeds	no treatment	early cool	W-excellent L-good	increaser/ decreaser	
<i>Salix drummondiana</i> satin willow	P	(1.0-3.0m) erect solitary, bunch	tillers/seeds	no treatment	early cool	W-excellent L-good	increaser/ decreaser	
<i>Salix exigua</i> sandbar willow	P	(0.5-4.0m) erect thicket	tillers/seeds	no treatment 22030 seeds/g	early cool	W-excellent L-good	increaser/ decreaser	

SHRUBS

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
		wet to mesic		shady woodlands, northern parklands, and Boreal forests	common	10,13,14		
	med.	wet to mesic		moist woods, swamps, Boreal forests	scattered	10,13,14		
		wet to mesic		moist woods, Boreal forest and northern parklands	common	3,4,14		9
		wet to mesic		moist woods, rich poplar woods, Boreal forest and parklands	scattered	14		
	fine to coarse	mesic	acidic, drought, flood	woods, banks, roadsides, throughout Alberta, good erosion control	common	2,3,4,7,8,9,10,11,12,13,14,15		1,2,8,9,10,13,15,18,24
	fine to coarse	mesic		hills and sandy open prairies	common	1,3,4,6		
	fine to coarse	mesic	drought, acidic, alkaline	open woods, ravines, sandhills, prairies and parklands, good erosion control	common	4,7,10,12		1,5,7,9,10,13,18,19,37
	fine to coarse	mesic	drought, saline, acidic	shady woods, recent burns/clearcuts, riverbanks, throughout Alberta, good erosion control	common	4,10,11,12,13	cultivar	1,5,9,21
		wet to mesic		along rivers and muskeg, Boreal forests		14		
	med. to coarse	mesic to dry	drought, alkaline	subalpine and alpine slopes and meadows, Rocky Mountains	common	9		1,9
				alpine meadows and slopes, Rocky Mountains		9		
	coarse	wet to mesic	saline, acidic, alkaline, flood	around sloughs, rivers, lakes, aspen and mixed woods, good erosion control	common	3,4,5,10,15	cultivar	1,5,9,18
				meadows, thickets, floodplains, subalpine streams and fens	scattered		cultivar	
			saline	river floodplains, bogs, fens and meadows		10,13,14		
		mesic		stream banks, aspen and mixed woods, thickets around prairie sloughs	common	3,4		9,15
		wet to mesic		subalpine thickets, river floodplains, slough margins, Boreal forests	locally common	10		5
				river floodplains, slough margins		12		5,9,18

SHRUBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Salix farriae</i> Farr's willow	P	(0.2-1.5m) erect solitary, bunch	tillers/seeds	no treatment	early cool	W-excellent L-good	increaser/ decreaser	
<i>Salix glauca</i> smooth willow	P	(0.5-1.5m) erect solitary, bunch	tillers, stolons /seeds	no treatment	cool	W-excellent L-good	increaser/ decreaser	
<i>Salix lucida</i> shining willow	P	(2.0-9.0m) erect solitary	tillers/seeds	no treatment	early cool	W-excellent L-good	increaser/ decreaser	
<i>Salix maccalliana</i> velvet-fruited willow	P	(1.0-5.0m) erect solitary	tillers/seeds	no treatment	early cool	W-excellent L-good	increaser/ decreaser	
<i>Salix myrtillifolia</i> myrtle-leaved willow	P	(0.1-1.0m) trailing solitary	stolons/seeds	no treatment	early cool	W-excellent L-good	increaser/ decreaser	
<i>Salix petiolaris</i> meadow willow	P	(1.8-5.0m) erect solitary, thicket	tillers/seeds	no treatment 1100 seeds/g	early cool	W-excellent L-good	increaser/ decreaser	
<i>Salix planifolia</i> flat-leaved willow	P	(0.5-4.0m) erect thicket	tillers/seeds	no treatment	early cool	W-excellent L-good	increaser/ decreaser	
<i>Salix pyrifolia</i> balsam willow	P	(1.0-3.0m) erect solitary, bunch	tillers/seeds	no treatment	early cool	W-excellent L-good	increaser/ decreaser	
<i>Salix reticulata</i> snow willow	P	(0.01-0.1m) erect mat	rhizomes/seeds	no treatment	early cool	W-excellent L-good	increaser/ decreaser	
<i>Salix scouleriana</i> Scouler willow	P	(2.0-7.0m) erect bunch, thicket	tillers/seeds	no treatment 14320 seeds/g	early cool	W-excellent L-good	increaser/ decreaser	
<i>Salix vestita</i> rock willow	P	(< 1.5m) erect solitary, bunch	seeds	no treatment	early cool	W-excellent L-good	increaser/ decreaser	
<i>Sambucus racemosa</i> red elderberry	P	(1.0-6.0m) erect solitary	rhizomes, tillers /seeds seed banker	stratify 630 seeds/g	early cool			
<i>Sarcobatus vermiculatus</i> greasewood	P	(0.3-3.0m) erect solitary	seeds/tillers	460 seeds/g	early	W-fair L-fair/toxic	increaser	
<i>Shepherdia argentea</i> thorny buffalo-berry	P	(1.0-6.0m) erect solitary, thicket	seeds	stratify 100 seeds/g	early N fixation	L-poor	increaser	
<i>Shepherdia canadensis</i> Canadian buffalo-berry	P	(1.0-3.0m) erect solitary, thicket	seeds	scarify 130 seeds/g	early, late N fixation	W-fair L-poor	increaser	
<i>Sorbus scopulina</i> western mountain ash	P	(1.0-4.0m) erect solitary	seeds	stratify		L-poor		
<i>Spiraea alba</i> narrow-leaved meadow sweet	P	(< 2.0m) erect solitary	seeds			L-poor	increaser	

SHRUBS

	HABITAT			NOTES:	DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE					
		wet to mesic		subalpine river floodplains, thickets, open coniferous woods, alpine slopes, marl bogs	scattered			
	fine to coarse	wet to mesic	acidic	alpine and subalpine thickets and slopes, moist coniferous woods, river flood plains, and marl bogs	common	10,13		1
		wet to mesic		lake and slough margins, river flood plains, and sand-dune slacks, throughout Alberta		12	cultivar	
		wet to mesic		riverbanks, wet thickets around slough margins and marshes, marl bogs, rocky subalpine slopes		10,13,14		
		wet to mesic		lake and stream banks, floodplains, thickets, fens, marl bogs, muskegs, moist coniferous forest, Boreal forests		14		
		wet to mesic		meadows, lakeshores, stream banks, throughout Alberta		4,12		
		wet to mesic	acidic	river and lake shores, meadows, marl bogs, muskegs, moist coniferous woods, active sand-dunes, throughout Alberta	common	12		
		wet to mesic		poplar and aspen woods, slough margins, muskegs, sand-dune slacks, Boreal forests		12,14		
		wet to mesic	acidic	open alpine and subalpine slopes and thickets, Rocky Mountains and Boreal forests		9		
	fine to coarse	wet to mesic	acidic, drought, saline, flood	dry coniferous woods, floodplains, sand beaches, active sand-dunes, foothills and Boreal forests	common	5,10		1,5
		wet		rocky open alpine and subalpine slopes, open coniferous woods, stream banks, Boreal forests and Rocky Mountains	scattered	9		
	fine to med.	wet to mesic		moist open woods, eastern Boreal forest		9		5,9,10,15,18, 21,35
	fine to coarse	dry	alkaline, saline	saline sloughs and flats, throughout prairies		1		4
	med. to coarse	wet to mesic	saline	open woods, coulees, around sloughs	common	1	cultivar	5,9,10,12,13,15, 18,26,29,35,37
	med. to coarse	mesic to dry	drought, saline, acidic, alkaline	open woods, riverbanks, parklands and Boreal forests, good erosion control	common	7,8,10,11, 12,13,15		1,9,13,15,18,19, 26,37
		mesic		woods and moist open slopes, parklands, Boreal forests and Cypress Hills	scattered			5,9
		wet to mesic		wet meadows and shores, parklands, Boreal forests	common			

SHRUBS

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Spiraea betulifolia</i> white meadow sweet	P	(0.2-0.8m) erect solitary, bunch	rhizomes/seeds	no treatment	early warm	W-poor L-poor	increaser	
<i>Symphoricarpos albus</i> snowberry	P	(0.5-1.0m) erect thicket	rhizomes/seeds seed banker	stratify 120 seeds/g	early warm	W-good L-poor	increaser	
<i>Symphoricarpos occidentalis</i> buckbrush	P	(0.5-1.0m) erect thicket	rhizomes/seeds	stratify 160 seeds/g	early warm	W-good L-poor	increaser	
<i>Vaccinium caespitosum</i> dwarf bilberry	P	(0.05-0.25m) erect-trailing mat	rhizomes/seeds	no treatment 11670 seeds/g	early warm	L-poor	increaser	
<i>Vaccinium membranaceum</i> tall bilberry	P	(0.5-1.0m) erect solitary, thicket	rhizomes/seeds	no treatment	early cool	L-poor	increaser	
<i>Vaccinium myrtilloides</i> common blueberry	P	(0.1-0.4m) erect thicket	rhizomes/seeds		early	L-poor	increaser	
<i>Vaccinium myrtillus</i> low bilberry	P	(0.1-0.3m) erect-trailing mat	rhizomes/seeds		early, late	L-poor	increaser	
<i>Vaccinium uliginosum</i> bog bilberry	P	(0.02-0.6m) erect-trailing mat	rhizomes/seeds		early	L-poor	increaser	
<i>Vaccinium vitis-idaea</i> cow-berry	P	(0.1-0.2m) erect-trailing mat	rhizomes/seeds		early	L-poor	increaser	
<i>Viburnum edule</i> low-bush cranberry	P	(0.5-2.0m) erect solitary, bunch	tillers/seeds, rhizomes seed banker	stratify	early cool	L-good	decreaser	
<i>Viburnum opulus</i> high-bush cranberry	P	(1.0-4.0m) erect solitary	seeds	stratify 30 seeds/g	early cool	L-good	decreaser	
<i>Yucca glauca</i> soapweed	P	(0.2-0.4m) erect-trailing solitary	seeds	50 seeds/g	cool symb: Yucca moth			

SHRUBS

	HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
	SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
	med.	mesic to dry	saline	thin woods, open slopes, Cypress Hills, Rocky Mountains, aspen groves and lodgepole pine forest	common	7		1,9,5
	med. to coarse	wet to dry	drought, saline, alkaline	open woodlands, valley slopes, rocky and sandy soils, parklands and Boreal forests, Cypress Hills	common	6		1,5,9,10,12,13,15,18,35
	fine to coarse	mesic to dry	drought, saline, alkaline	open woodland, prairie slopes, coulees, parklands and prairies, good erosion control	common	1,2,3,4,6,7		1,5,9,18,24,26,35,37
		mesic to dry		pine woods and open slopes, Boreal forest and Cypress Hills		7		
	med.	mesic to dry	acidic	moist montane woods, coniferous forests, southern Rocky Mountains		7,8		9
	fine to coarse	mesic to dry		dry woods, sandy ground		8,12		9
		mesic to dry		montane to subalpine woods, coniferous forests, southern Rocky Mountains		7,9,13,14		
		wet to mesic	acidic	alpine slopes and bogs, Boreal forests and Rocky Mountains		15	I	
		mesic to dry	acidic	coniferous woods, dry bogs, alpine slopes, sandy woodlands, Boreal forest and Rocky Mountains	common	8,10,11,13,15		9
	med. to coarse	wet to mesic		rich moist woodlands, parklands	common	10,11,12,13,14,15		9
		wet to mesic	acidic, drought	moist woods, parklands	common	12		5,10,13,15,18,26,29,35,37
	med. to coarse	dry		dry slopes, prairies	rare			

TREES

SCIENTIFIC NAME COMMON NAME	PBA	GROWTH FORM	REPRODUCTION	SEED INFORMATION	ECOLOGY/ PHYSIOLOGY	FORAGE VALUE	GRAZING RESPONSE	
<i>Abies balsamea</i> balsam fir	P	(< 18m) erect solitary	seeds	stratify 130 seeds/g	cool			
<i>Abies lasiocarpa</i> subalpine fir	P	(< 25m) erect solitary	seeds	stratify 77 seeds/g	cool	L-fair	decreaser	
<i>Acer glabrum</i> rocky mountain maple	P	(1.5-10m) erect solitary	seeds	stratify 30 seeds/g	cool			
<i>Betula papyrifera</i> white birch	P	(< 30m) erect solitary	seeds, tillers	stratify 3040 seeds/g	early cool	L-fair	decreaser	
<i>Larix laricina</i> tamarack	P	(< 20m) erect solitary	seeds	no treatment 700 seeds/g	cool	W-poor L-poor	decreaser	
<i>Picea engelmannii</i> Engelmann spruce	P	(25-30m) erect solitary	seeds	no treatment 300 seeds/g	cool mycorrhizal	W-good L-poor	decreaser	
<i>Picea glauca</i> white spruce	P	(< 40m) erect solitary	seeds	no treatment 500 seeds/g	early, late cool mycorrhizal	W-good L-poor	decreaser/ invader	
<i>Picea mariana</i> black spruce	P	(< 10m) erect solitary	seeds	no treatment 890 seeds/g	late cool mycorrhizal	W-good L-poor	decreaser/ invader	
<i>Pinus banksiana</i> jack pine	P	(5-20m) erect solitary	seeds	stratify 290 seeds/g	early, late cool mycorrhizal	W-fair L-poor	decreaser/ invader	
<i>Pinus contorta</i> lodgepole pine	P	(20-30m) erect solitary	seeds	stratify 210 seeds/g	late cool mycorrhizal	W-fair L-poor	decreaser/ invader	
<i>Populus balsamifera</i> balsam poplar	P	(to 25m) erect solitary	rhizomes, tillers /seeds	no treatment	early, late cool allelopathic-alder	W-good L-poor	increaser/ decreaser/ invader	
<i>Populus tremuloides</i> trembling aspen	P	(6-30m) erect solitary	rhizomes, tillers /seeds	no treatment 7930 seeds/g	late cool	W-good L-fair	decreaser/ invader	
<i>Pseudotsuga menziesii</i> douglas fir	P	(50m) erect solitary	seeds	stratify 100 seeds/g	late cool	L-poor		

TREES

HABITAT				DISTRIBUTION	NATURAL REGION	CULTIVAR /ECOVAR	SEED/PLANT AVAILABILITY
SOIL TEXTURE	SOIL MOISTURE	SOIL TOLERANCE	NOTES:				
	wet to mesic		moist woods, commonly with white spruce and poplar, Boreal forests and Rocky Mountains	common			1,9,10,13,17
fine to coarse	mesic	acidic	subalpine forests, Rocky Mountains cool, moist north and west facing slopes, good erosion control	common	8		1,5,9,37
fine to coarse	mesic	acidic	montane slopes, deciduous and mixed forests, southern Rocky Mountains	scattered			9,13
fine to coarse	wet to mesic	acidic, flood, drought	Boreal and montane forests and parklands, along rivers, forest openings, thin rocky soils and dry bogs	common	10,12		1, 5, 9,10,15,17, 18,21,26,29,35
med.	wet to mesic	acidic	muskeg and marshy woods, Boreal forests, Rocky Mountains	common	8,10,11, 12,13,14		1,9,15,18
fine to coarse	mesic	acidic, drought, flood	subalpine and montane forests	common	8,11		5,9,13,15,18
fine to coarse	mesic	acidic, drought, flood	montane and Boreal forests	common	10,11,12, 13,14,15		1,9,10,17,18, 21,29,35
med.	wet to mesic	acidic	muskegs, swampy woodlands, Boreal forests	common	8,10,11, 12,13,14, 15		10
coarse	mesic to dry	acidic, drought, alkaline	sandy and gravelly soils, Boreal forests good erosion control	common	12,13,14		1,10,5
fine to coarse	mesic to dry	acidic, drought, alkaline	lower to middle elevations on the eastern Rocky Mountain slopes, good erosion control	common	7,8,10,11		1,5,9,10,15,17, 18,21,29,35,37
fine to coarse	wet to mesic	flood, saline, alkaline	Boreal forests, parklands, riverbanks, alluvial flats, good erosion control	common	10,11,12, 13,14		1,9,12,21
fine to coarse	mesic	flood, drought, alkaline	moist areas in prairies, widespread in parklands and Boreal forests, excellent erosion control	common	4,7,10,11, 12,13,14, 15	cultivar	1,5,9,10,12,17, 19,21,26
med.			Southern Rocky Mountain forests	scattered	7		5,9,37

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APPENDIX A

CULTIVARS & ECOVARS IN DEVELOPMENT IN WESTERN CANADA

ALBERTA

1. Ag Canada (Lethbridge) - Dr. Ken May

- Ecovars:**
- awned wheat grass (*Agropyron trachycaulum* var. *unilaterale* [*Elymus trachycaulus* var. *subsecundum*])
 - blue grama (*Bouteloua gracilis*)
 - native Bromus spp. (4)
 - Idaho fescue (*Festuca idahoensis*)
 - little bluestem (*Schizachyrium scoparium*)
 - mountain rough fescue (*Festuca campestris*)
 - plains rough fescue (*Festuca hallii*)

2. Alberta Environmental Centre (Vegreville)

- Cultivars:**
- alpine bluegrass (*Poa alpina*)
 - awned wheat grass (*Agropyron trachycaulum* var. *unilaterale*)
 - broad-glumed wheat grass (*Agropyron violcaeum*)
 - Rocky Mountain fescue (*Festuca saximontana*)
 - spike trisetum (*Trisetum spicatum*)

- Ecovars:**
- June grass (*Koeleria cristata*)
 - alpine milk vetch (*Astragalus alpinus*)
 - yarrow (*Achillea millefolium*)
 - Canada goldenrod (*Solidago canadensis*)
 - American vetch (*Vicia americana*)

SASKATCHEWAN

1. Ag Canada (Melfort); Dr. Scott Wright

- Cultivars:**
- northern wheat grass (*Agropyron dasystachyum* [*Elymus lanceolatus*])
 - western wheat grass (*Agropyron smithii*)

- Ecovars:**
- needle-and-thread grass (*Stipa comata*)
 - porcupine grass (*Stipa curtisetata*)

2. University of Saskatchewan: Dr. Jim Romo

- Ecovar:**
- winter fat (*Eurotia lanata*)

3. Ag Canada (Swift Current): Dr. Andrew Kielly; Dr. Bruce Coulman

- Ecovars:**
- prairie sandreed (*Calamovilfa longifolia*)
 - awned wheat grass (*Agropyron trachycaulum* var. *unilaterale*)

APPENDIX B

NATIVE SEED/PLANT SUPPLIERS

1. Alberta Nurseries and Seeds Ltd., Box 20, Bowden, Alberta, T0M 0K0, (403)224-3545
2. ALCLA Native Plant Restoration Inc., 3208 Bearspaw Drive, N.W. Calgary, Alberta, T2L 1T2, (403)282-6516
3. Arctic Alpine Seed Co., 105 Granite Rd., Whitehorse, Yukon, Y1A 2V8, (403)667-2756
4. Big Sky Wholesale Seeds, Box 852, Shelby, Montana, 59474, (406)434-5011
5. Bitterroot Native Growers Inc., 445 Quast Lane, Corvallis, Montana, 59828-9406, (406)961-4991
6. Blazing Star Wildflower Seed Co., Box 143, St. Benedict, Saskatchewan, S0K 3T0, (306)289-2046
7. Blooming Prairie, 10328 University Avenue, Edmonton, Alberta, T6E 4P4, (403)462-3257
8. Borealis Botanicals, Box 91, Cochrane, Alberta, T0L 0W0, (403)932-2583
9. Bow Point Nursery, Box 16, Site 24, RR 12, Calgary, Alberta, T3E 6W3, (403)242-8018
10. Cheyenne Tree Farms Ltd., Box 49040 9647-41 Avenue, Edmonton, Alberta, T6E 6H4, (403)456-2464
11. Eastern Slopes Rangeland Seeds Ltd., Box 273, Cremona, Alberta, T0M 0R0, (403)637-2473
12. Coaldale Nurseries, Box 1267, Coaldale, Alberta, T0K 0L0, (403)345-4633
13. The Conservancy, 51563, Range Road 212A, Sherwood Park, Alberta, T8G 1B1
14. Dynamic Seeds Ltd. Box 813, Fairview, Alberta, T0H 1L0, (403)835-5435
15. Eagle Lake Nurseries Ltd., Box 2340, Strathmore, Alberta, T1P 1B9, (403)934-3622
16. Enviroscapes, 1213-5 Ave. S., Lethbridge, T1J 0V6, (403)653-4124
17. Foothills Nurseries, 2626-48 Street S.E., Calgary, Alberta, T2B 1M4, (403)272-3200
18. Greenview Nurseries, Box 12, Site 16, RR 7, Calgary, Alberta, T2P 4G7, (403)936-5936
19. Grumpy's Greenhouse & Gardens, Box 2488, Pincher Creek, Alberta, T0K 1W0, (403) 627-4589
20. Hannas Seeds, Box 849, Lacombe, Alberta, T0C 1S0, (403)782-6671
21. Hillson Nursery, P.O. Box 39, Rochester, Alberta, T0G 1Z0, (403)698-3956
22. Joffre Greenhouse, RR 2, Lacombe, Alberta, T0C 1S0, (403)342-8066
23. K & C Silviculture, P.O. Box 25019, Red Deer, Alberta, T4R 2M2, (403)347-3002
24. Knutson & Shaw Growers, Box 295, Vulcan, Alberta, T0L 2B0, (403)485-6688
25. Laidlaw Nursery, Box 316, Tofield, Alberta, T0B 4J0, (403)662-2778
26. Miller's Native Plants, 426 Keeley Way, Saskatoon, Saskatchewan, S1J 4B2, (306)374-4785
27. Newfield Seeds, Box 100, Nipawin, Saskatchewan, (306)862-4678
28. Northern Vigor Seeds Ltd., Box 67, Sexsmith, Alberta, T0H 3C0, (403)532-1344

29. Parkland Nurseries, RR 2, Red Deer, Alberta, T4N 5E2, (403)346-5613
30. Pickseed, Box 3230, Sherwood Park, Alberta, T8A 2A6, (403)464-0350 1-800-265-3925
31. Prairie Habitats, P.O. Box 1, Argyle, Manitoba, R0C 0B0, (204)467-9371
32. Prairie Seeds Inc., Box 428, Nisku, Alberta, T0C 2G0, (403)955-7345 1-800-222-6443
33. The Professional Gardener Company Limited, 915-23 Avenue S.E., Calgary, Alberta, T2G 1P1
(403)263-4200
34. Rangeland Seeds, Box 928, Vulcan, Alberta, T0L 2B0, (403)485-6448
35. Sunstar Nurseries, 810-167 Avenue N.E., RR 6, Site 6, Box 17, Edmonton, Alberta, T5B 4K3
(403)472-6103
36. Tree Things Resources Ltd., RR1, Busby, Alberta T0G 0H0, (403)967-2923
37. Valley Nursery, P.O. Box 4845, Helena, Montana, 59604, (406)442-8460
38. Wilderness Nurseries, Perryvale, Alberta, T0G 1T0, (403)698-2699
39. Williamson Seeds, Box 6, Pambrun, Saskatchewan, (306)582-4505

Further information available from:

1995 Native Plant Source List & Collection & Use Guidelines
 Alberta Native Plant Council
 Garneau P.O. Box 52099
 Edmonton, AB T6G 2T5

APPENDIX C

GLOSSARY

A-Horizon:	The upper layer of mineral soil consisting of accumulations of organic matter at or near the surface, with lower soils characterized by a loss of clay, iron, or aluminum and a higher concentration of quartz or other resistant materials of silt or sand size.
Agronomic:	Of or relating to the science of agronomy (the practice of field-crop production and soil management).
Alien:	A plant that did not originally occur in an area where it is now established, but which arrived directly or indirectly by human activity.
Allelopathic:	An action or substance produced by or in one plant species that inhibits or restricts the growth of another plant species. These substances most commonly include toxic organic materials produced directly by the plant, or as a result of the decomposition of plant residues.
Biodiversity:	"The diversity of life in all its forms and all its levels of organization" (Hunter 1990:7), and includes the genetic diversity within a species, the diversity of species within an ecosystem, and the diversity of ecosystems within landscapes.
Brunisolic Order:	A soil group which occurs under a wide variety of climatic and vegetative conditions, having sufficient horizon development (including Bm or Btj horizons) to exclude them from the Regosolic Order, but lack the degrees or kinds of horizon development found in other orders. They are often reddish in colour. The great groups within this order include: Melanic Brunisols, Eutric Brunisols, Sombric Brunisols and Dystric Brunisols.
Chernozemic Order:	A soil group that has developed under grasses and forbs associated with extremely dry to mesic conditions, or under grassland-forest transition vegetation, in cool to cold, sub-arid to subhumid climates. These soils have dark coloured Ah, Ahe, or Ap horizons, and a B or C horizon of high base saturation. This order includes: Brown, Dark Brown, Black and Dark Gray great groups.
Climax:	The final, or most mature, plant community capable of self perpetuation under the prevailing climatic and soil conditions. A climax plant species is defined as one that dominates the site under climax conditions.
Common Species:	A species widely distributed and easily found within a given area.
Community:	Populations of plants or animals living and interacting with one another in a given area.
Cool Season Plants:	Plants mostly of temperate origins completing the major proportion of their growth during the spring and early summer months.
Cover:	The area of ground covered by all living (including stems and leaves) and dead (litter) plant material that is produced naturally on a site, expressed as a percentage of the total area. Bare soil is not cover. This definition of cover is also referred to as ground cover, canopy cover or aerial cover.
Crimping:	A soil stabilization technique that presses spread straw into the soil in a wave-like pattern. Crimping decreases surface erosion and creates a favorable microenvironment for plants.

Critical Link Species:	A species whose presence within a community is vital to maintaining a particular ecosystem function, without which the community structure would be significantly altered.
Cryosolic Order:	A soil group including mineral or organic soils that have perennially frozen material within 1 m of the surface. They are the dominant soils of the northern regions of continuous permafrost, and are best developed in organic and poorly drained, fine textured materials. This order consists of three great groups: Turbic Cryosols, Static Cryosols, and Organo Cryosols.
Cultivar:	An artificially developed genetic variety of a particular plant species that has specific morphological, physiological, cytological, chemical or other agronomic characteristics, which are retained when reproduced either sexually or asexually.
Ecosystem:	A system of living organisms interacting with each other and their environment, linked together by energy flows and material cycling.
Ecosystem Function:	Interacting processes fundamental to the needs of all ecosystem members, such as carbon dioxide-oxygen exchange, water collection and purification, soil erosion control, decomposition and nutrient recycling, etc. These functions are frequently the by-products of living organisms.
Ecotype:	A local ecological race adapted through natural selection to a particular habitat.
Ecovar:	An artificially developed genetic variety of a particular plant species giving equal emphasis to ecological and agronomic characteristics. It is usually defined by environmental conditions under which it will grow and develop normally. In contrast to cultivars, ecovars are characterized by greater genetic diversity. Note: there are no known ecovars available at present, however several are currently in development.
Edaphic:	Of or relating to the soil.
Eluvial:	Soil material that has been transported via suspension or solution to another soil horizon via the downward or lateral movement of water.
Eolian:	Silt, sand, or other small sediments that have been moved and deposited by wind action.
Fluvial:	Materials that have been moved and deposited by flowing water (i.e., streams or rivers).
Glacial Drift:	All rock material carried by glacier ice and glacial meltwater, or rafted by icebergs.
Glaciofluvial Deposits:	Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice.
Glaciolacustrine Deposits:	Material moved by glaciers and subsequently sorted and deposited as layers of fine sediment on lake bottoms.
Gleysolic Order:	A group of soils developed under wet conditions and permanent or periodic reduction. Some horizons within these soils have low chromas, or prominent mottling, or both. The great soil groups within this order include: Gleysols, Humic Gleysols, and Luvic Gleysols.
Illuvial:	Soil material which has been moved from one soil horizon to another (usually a lower one) by precipitation from solution or deposition from suspension.
Invasive:	A plant that has moved into a habitat and reproduced so aggressively that it has displaced the original structure of the vegetation community.
Keystone Species:	A species that is disproportionately important in the maintenance of community integrity, and without which significant changes to the community would occur.

Lithology:	Of or relating to the type of bedrock or parent material underlying a particular soil group.
Luvisolic Order:	A group of soils that have eluvial Ae horizons, and illuvial Bt horizons in which silicate clay is the main product of accumulation. These soils develop under forest or forest-grassland transition in a moderate to cool climate. The Gray Luvisols are the most common great group in western Canada.
Moisture Regime:	The relative moisture available for plant growth over the growing season. It is relative to a given regional climate as represented by natural regions. Variation of available moisture results from redistribution of precipitation by edaphic and topographic factors. This regime is divided as follows:
-Very Xeric:	Water removed extremely rapidly in relation to supply. Soil is moist for a negligible time after precipitation.
-Xeric:	Water is removed very rapidly in relation to supply. Soil is moist for brief periods following precipitation.
-Subxeric:	Water removed very rapidly in relation to supply. Soil is moist for short periods following precipitation.
-Submesic:	Water removed readily in relation to supply. Water available for moderately short periods following precipitation.
-Mesic:	Water removed somewhat slowly in relation to supply. Soil may remain moist for a significant, but sometimes short period of the year. Available soil moisture reflects climatic inputs.
-Subhygric:	Water removed slowly enough to keep the soil wet for significant part of the growing season. Some temporary seepage and possible mottling below 20 cm.
-Hygric:	Water removed slowly enough to keep the soil wet for most of the growing season. Permanent seepage and mottling are present. Possibly weak gleying.
-Subhydric:	Water removed slowly enough to keep the water table at or near the surface for most of the year. Gleyed mineral or organic soils. Permanent seepage less than 30 cm below the surface.
-Hydric:	Water removed so slowly that the water table is at or above the soil surface all year; gleyed mineral or organic soils.
Morainal:	Sediments carried and deposited by glacial action as ground, lateral, recessional, or terminal moraines. This term may also be used to describe topography which has been shaped by glacial action.
Mycorrhizal Fungi:	The symbiotic relationship between certain fungi and the roots of certain plants. The fungi grow on the outside of the root or within the outer root tissues and enhance the plant's uptake of nutrients such as phosphorous in exchange for carbon.
Natural Area:	An area that is in a largely undisturbed condition, characterized by plant and animal species native to the area.

Organic Order:	A group of soils that have developed dominantly from organic deposits. The majority of organic soils are saturated with water for most of the year, but some are not usually saturated for more than a few days. They are characterized by a 17% or higher organic content, and include the great groups: Fibrisols, Mesisols, Humisols, and Folisols.
P-PE:	Potential evaporation deficits/surpluses, where P is total monthly precipitation (mm) and PE is potential evapotranspiration (mm). The latter measurement is estimated from a formula that takes into account mean maximum and minimum temperatures and extraterrestrial solar radiation.
pH:	A numerical measure of the acidity or hydrogen ion activity of a soil. Acidic soils are expressed by low pH values, and alkaline soils by high pH values. A pH of 7.0 is neutral.
Pure Live Seed:	Seeding rates based on Pure Live Seed (PLS) compensate for the purity and germination frequency of the seed ($PLS = \% \text{ germination} \times \% \text{ purity}$).
Rare Species:	A species not widely distributed nor easily found within a given area. Rare species include but are not necessarily limited to endangered, threatened or vulnerable species.
Reclamation:	The process of reconvertng disturbed land to its former or other productive uses.
Regosolic Order:	A group of soils having no horizon development, or development of the A and B horizons are insufficient to meet the requirements of other soil orders. Regosols are the only great group within this order.
Restoration:	The process of restoring site conditions as they were before the land disturbance.
Revegetation:	The establishment of vegetation that replaces the original plant cover following land disturbance.
Rhizome:	An elongated, usually underground, horizontal or ascending root-like stem; a rootstock.
Scarification:	The artificial break down of the outer seed coat by mechanical or chemical means. These methods are used to improve germination frequency.
Soil Correlation Area:	A recent mapping of soils within Alberta, placing a greater emphasis on local ecological, climatic, and topographical differences between areas.
Solonetzic Order:	A group of soils developed under grass or grass-forest vegetation cover in semiarid to subhumid climates. The soils have a stained brownish or blackish solonetzic B (Bn, Bnt) horizon and a saline C horizon. The order includes the Solonetz, Solodized Solonetz and Solod great groups.
Stratification:	The breaking of seed dormancy by exposing the seed to prolonged or repeated freezing under moist conditions. However, alternating warm and cold stratification methods are also frequently employed. These methods are used to improve germination frequency.
Succession:	The gradual replacement of one plant community by another in a naturally occurring progressive development toward climax vegetation.
Till:	Unstratified, non-sorted deposits of gravel, boulders, sand and finer materials which have been moved by glacial action.
TZ test:	A test used to determine the germinating potential of seed. Tetrazolium chloride, a soluble salt, reacts with living tissue, staining it various colours of red.
Warm Season Plants:	Plants mostly of tropical origins completing the major proportion of their growth, during the mid to late summer months. Their physiology demands full sunlight and warmer temperatures.

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Review of manuscript

1. The first part of the report discusses the background of the project and the objectives of the study.

2. The second part of the report describes the methodology used in the study, including the data collection and analysis techniques.

3. The third part of the report presents the results of the study, which show that the proposed method is effective in achieving the objectives of the study.

4. The fourth part of the report discusses the conclusions of the study and the implications of the findings for future research.

5. The fifth part of the report provides a summary of the key findings of the study and a list of references.

6. The sixth part of the report contains a list of figures and tables that are used in the study.

7. The seventh part of the report provides a list of abbreviations and a glossary of terms used in the study.

8. The eighth part of the report contains a list of appendices that provide additional information about the study.

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23. The twenty-third part of the report provides a list of abbreviations and a glossary of terms used in the study.

24. The twenty-fourth part of the report contains a list of appendices that provide additional information about the study.

25. The twenty-fifth part of the report provides a list of references that are cited in the study.

26. The twenty-sixth part of the report contains a list of figures and tables that are used in the study.

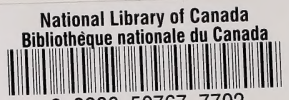
27. The twenty-seventh part of the report provides a list of abbreviations and a glossary of terms used in the study.

28. The twenty-eighth part of the report contains a list of appendices that provide additional information about the study.

29. The twenty-ninth part of the report provides a list of references that are cited in the study.

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